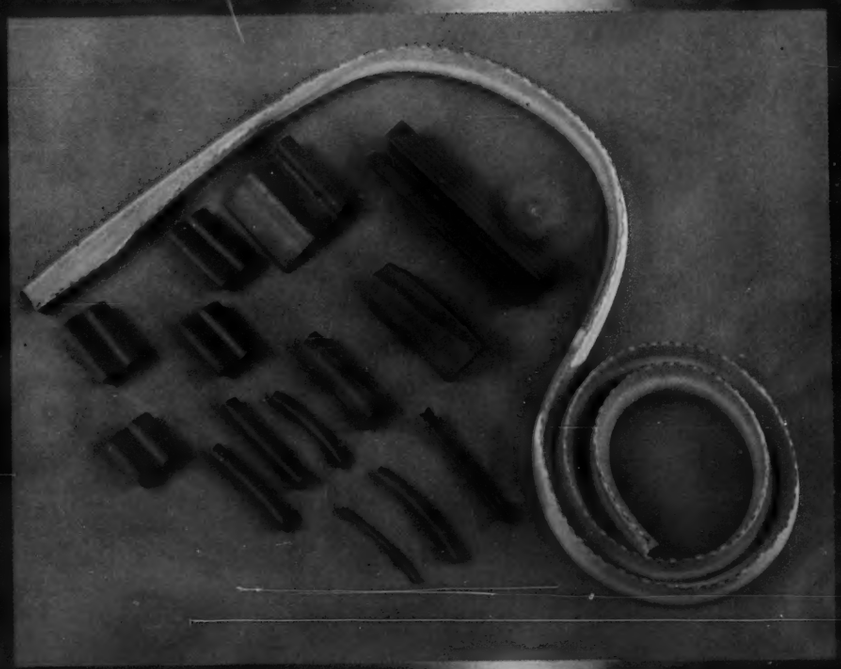
Design News



Silicone rubber for seals, O-rings and gaskets. Page 8

A CAHNERS PUBLICATION

APRIL 24, 1961

NEW DEPARTURE PRODUCT INFORMATION

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NBP April 24, 1961 BPA
Vol. 16 No. 9
Worldwide Coverage of Technical

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News and Engineering Ideas. More than 48,000 copies every other Monday.

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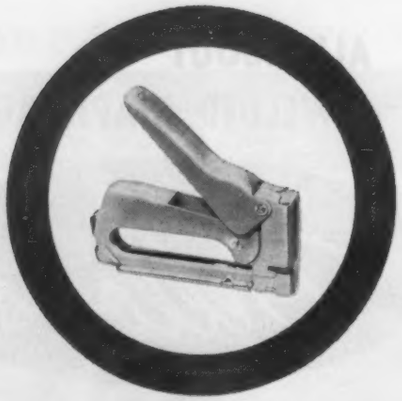

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SOUNDING BOARD

FOR OUR READERS

Federal Aid

Your editorial, "Federal Aid", prompts the following comments:

1. I agree with your thesis that federal aid is necessary to improve the utilization of our human resources. I take this position both from the point of view of increasing our stature in the eyes of all the world and from the standpoint of building a less frustrated, more self-confident citizenry.
2. Your points 1 and 3 seem to be mutually at odds. If a needy student is sent to college with federal aid (scholarship or loan), his family will not need the income tax deduction. If tuition and college expense are made tax deductible, more of the mediocre students will flock in, but this will help very few of the "bright but needy" ones. Tax relief will not help a $4000 wage earner meet a $2000 annual expense.
3. I vehemently protest your point 2 from many angles. First, a college education should be available to all comers—the more people exposed to education, the better off we are as a nation. Second, who, short of Plato, is capable of deciding where to draw the line of privilege? This is one of the things we loudly and rightly decry from authoritarian governments wherever we find them. Third, whence the philosophy of shrinking output rather than expanding facilities? This nation did not achieve its position of world leadership by following a defeatist philosophy such as you propose.

ALVIN H. SHAIRMAN
Worcester, Mass.

Your editorial suggestions for doing something about higher education make a lot of sense to me.

I am glad you included the desire to learn along with the ability to learn. Your loan and pay-back scheme is very good.

I am sending a copy of your article to my Congressman.

HOWARD L. COBB
Boonton, N. J.

In response to your editorial in DESIGN NEWS (Jan. 30, 1961), let me suggest that you should look through the political deception that surrounds the clatter for federal aid to education. . . .

I recommend that you read J. Edgar Hoover's "Masters of Deceit" as a beginning on how to recognize "fronts" in front of "fronts"!

J. WILLIAM SYDNOR
Peoria, Ill.

. . . America should be proud of its educational system, but should also strive to make it an even better one. However, let's not create an even greater bureaucratic monster than already exists.

People should be given federal tax relief so that money can be used directly by local and state authorities. I suggest that the proposed 23rd Amendment would be a tremendous step in that direction. . . .

WILLIAM F. BECK
East Hartford, Conn.

Interservice Cooperation

May I belatedly express the appreciation of Frankford Arsenal for publication of the article on PAD (Nov. 21, 1960, DESIGN NEWS). It has already resulted in increased awareness of the important role played by the Arsenal in development of ballistic devices.

I realize that space limitations probably precluded publication of the portion of the article crediting the Naval Ordnance Test Station, China Lake, Calif., with development of the basic features of the XM series of rocket-catapults. As you know, their RAPEC was the take-off point for the Arsenal development. Would it be possible to arrange to give due credit to NOTS and the two inventors (R. J. Zabelka and C. A. Glass)?

W. H. SIMMONS
U. S. Army Ordnance
Frankford Arsenal

Auto Safety

Here are my comments about automobile safety: (1) brake lines should be stainless steel or equivalent; (2) brake hoses should have wire cord or equivalent construction and be dated; (3) tires should be built to specs, dated and plainly marked for maximum mileage and maximum years of use, and (4) all items that affect safety should be built to specs and so marked. The specs should be set by law. The only loophole in the specs should be the words "equivalent or better", which will allow design improvements. At the same time, set up a special license for limited production. The law also should require that the specs have to be improved as know-how improves any place in the world.

ROBERT K. TANNER
Tanner Automotive Co.
Millbrook, N. Y.

Engineer in a Cocoon

The President of ITT Federal Laboratories, I. Nevin Palley, thinks that engineers as a group have a professional inferiority complex. "Curiously, while his profession is dedicated to progress, the engineer is doing little to advance his own cause; instead of changing his personality to meet the new demands of his art, to become a leader, he tends to seek refuge. Instead of looking for new horizons, he weaves a cocoon of job security and fringe benefits and snuggles safely inside."

Mr. Palley was speaking at the recent International Convention of the Institute of Radio Engineers. His remarks, however, are not intended only for the electrical engineers. Rather, he seems to direct his comments to the entire engineering profession.

According to the ITT executive, only when the modern engineer breaks out of his shell and shucks the collectivism that shrouds his talent, will he be able to collect professional and financial rewards.

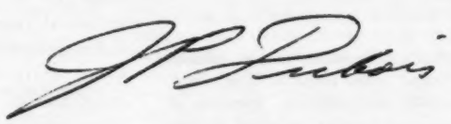
I wonder if engineers have really woven this cocoon around themselves? Perhaps it is rather a direct result of the way in which engineers are used that is causing the problem of the eight-to-five engineer.

It is only necessary to glance through the typical design room or engineering department to see why engineers no longer consider themselves very professional. Acres of drafting boards do not make for creative and professional attitudes. Similarly, technician-type jobs given to engineers on such a large scale cannot help but degrade the engineering profession.

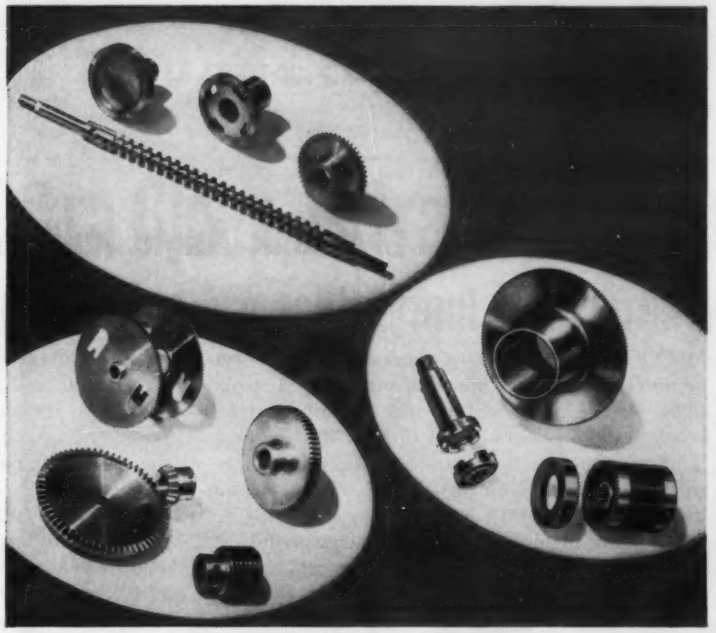
How can a graduate engineer, sitting among hundreds of others and doing what is essentially manual labor, possibly have any feeling of professionalism?

It seems to me that industry is the group most responsible for degradation of the engineering profession we find so prevalent today. How can we blame an engineer for an eight-to-five attitude when management thinks of him as just another peon at a drafting board?

If management really wants creative engineers with drive and a professional attitude, management will have to break the cocoon. The next move is up to industry.



Managing Editor



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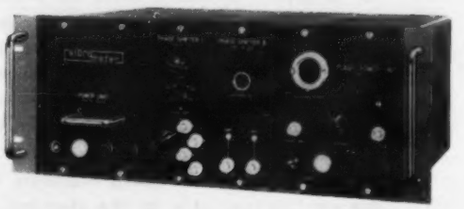
Crank Angle Indicator Aids Automotive Research

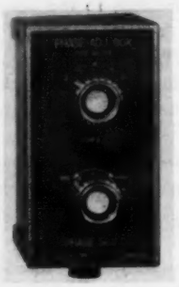
R. F. Stengel, German Editor

MUNICH, GERMANY—Generated by a flywheel-mounted magnet, an induction pulse fires a strobe light, freezing shaft motion and indicating engine crank angle on a graduated disc on the flywheel. The same pulse, with controlled phase shift, is used to put a marker on an oscilloscope trace of engine data. Correlation with less than one deg error between crank angle and oscilloscope mark permits accurate evaluation of engine performance.

In a pulse transformer and phase shifter, the front slope of the induced pulse triggers a nearly rectangular pulse with steep flanks and variable phase lag. This fires the strobe light; actual crank angle is read on the disc. The oscilloscope trace is suppressed at a point corresponding within one deg to the crankshaft position.

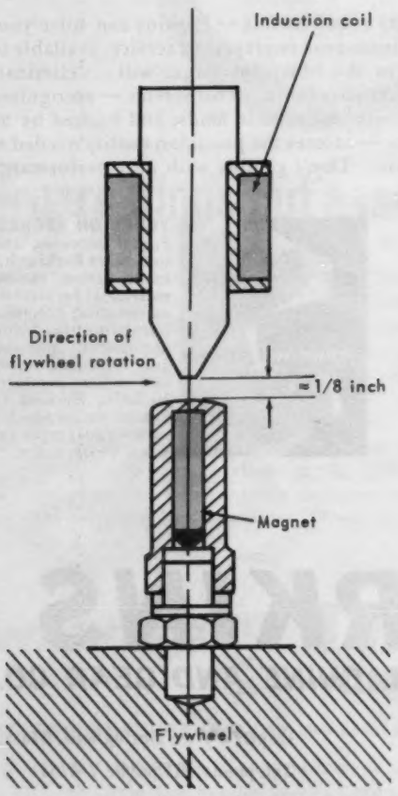
The device is used to measure ignition lag, to check characteristics of diesel injection systems and to investigate engine combustion efficiency. It is a development of Institut fuer Motorenbau Dr. Huber and is built under license by Vibrometer AG, Fribourg-Moncor, Switzerland.

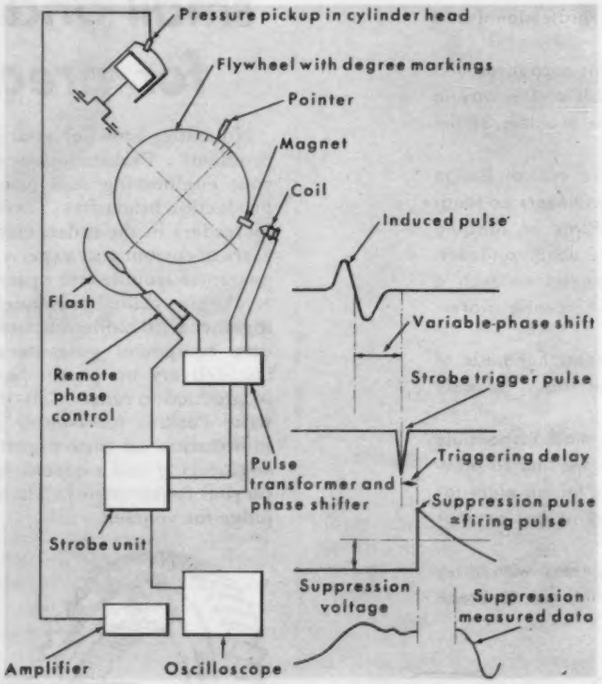




INDICATOR houses all components except phase shifter. Phase shifter is portable, permits remote control.

FLYWHEEL-MOUNTED MAGNET generates induction pulse of about 2v in stationary coil. Pulse is input for special pulse transformer and phase-shifter unit.





PULSE TRANSFORMER and phase-shifter unit amplifies magnet-induced pulse beyond linearity limits of each stage; input noise is largely suppressed. Resulting pulse triggers monostable multivibrator. Duration of pulse is set with different capacities and potentiometer mounted in handle of portable strobe light. Rectangular output pulse is differentiated, giving two triangular voltage pulses of opposite sign. First nearly coincides with input pulse, second with capacity and potentiometer-controlled phase lag which triggers firing pulse of strobe light and simultaneously acts to blank oscilloscope trace.

DESIGN NEWS Reopens German Office

Curtis W. Lowe, Manager, European Division

ZURICH, SWITZERLAND—Rudolph F. Stengel has been appointed German Editor for DESIGN NEWS. Born in Germany, he graduated from the Technische Hochschule in Munich as a mechanical engineer. After moving to the U. S., he did graduate work at Lehigh University (engineering, mathematics), Pennsylvania University (vibration, aerodynamics, diesel engines) and University of Buffalo (heat transfer, business administration).

Completely bilingual even in technical terminology, he served in the U. S. Army for two years as technical translator and writer. For eight years he did engineering work on process development of hot metal extrusion, as well as gas rectification and liquefaction. He also has designed materials handling equipment.

Mr. Stengel comes to DESIGN NEWS from the Linde Co. Engineering Laboratory. He will be working out of offices at Thierschstrasse 15, Munich 22, Germany.

Stainless Steel Alloy Has Improved Machinability

E. J. Stefanides, Central States Editor

BRIDGEVILLE, PA.—A new grade of free-machining chromium-nickel stainless steel has been developed and made commercially available by Universal-Cyclops Steel Corp. The alloy has been designated Uniloy 303MA and provides greatly improved machinability, corrosion resistance and surface finish over the regular free machining AISI type 303 stainless.

These advantages are achieved by adding a very small amount of aluminum in addition to the sulphur commonly used to gain improved machinability in type 303.

The proper combination of aluminum and sulphur makes possible a reduction in the final sulphur content to approximately one-half the level normally contained in type 303. This reduction reduces some of the undesirable side effects of the sulphur.

Normally, the sulphur present takes the form of nonmetallic stringers and inclusions which adversely affect fabrication and component performance. These nonmetallic inclusions in regular 303 have caused considerable problems in rolling and forming operations.

The new alloy can be successfully roll-threaded, obtaining good surface finish and low costs. It also has been used successfully for a number of forming operations in which splitting was previously an insurmountable problem with regular type 303.

Uniloy 303MA can be machined up to 50 percent faster and prolongs tool life, compared to regular AISI grade 303. Its formulation is protected by patent and it is said to be the first major grade of free-machining stainless steel to be introduced in the last 25 years.

Type 303 (100X) Type 303MA (100X)

PHOTOMICROGRAPHS show "cleaner" steel obtained by reduction of sulphur content. This reduction results in higher corrosion resistance (25 times greater than that of type 303 in Huey test).

TYPICAL COMPONENTS fabricated from new alloy.

Setko's 23 Years of Progressive Engineering Experience Keeps Screws Modern as Tomorrow's Products

SETKO NEWS

We Specialize in Solving Puzzling Screw Problems

Vol. 4, Issue No. 1 Bartlett, Illinois (Chicago Suburb) Progress Edition

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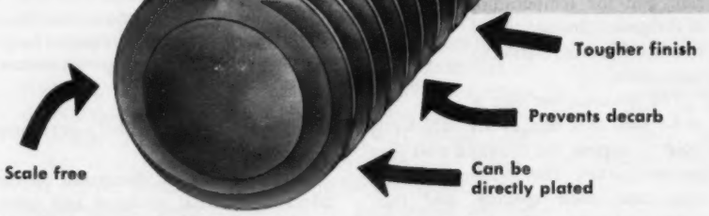
because only SETKO Screws are Isothermal Heat Treated

THIS HEAT TREATING PROCESS IMPARTS A DISTINCTIVE BLUE-BLACK COLOR WHILE PROVIDING DISTINCTIVE PERFORMANCE CHARACTERISTICS . . . YET, IT COSTS YOU NOTHING EXTRA.

Extensive use has proven that socket screw products treated by this process are tougher and cleaner. Threads, heads, points, shanks, etc. are scale-free. This means better fit, better performance. Also, Isothermal heat treated socket screw products prevent decarburization...and it costs you nothing extra. It's another Setko exclusive in the socket screw field.

NU-CUP POINT SLABBED OR SOCKET HEAD
STANDARD HEXAGON SOCKET SET SCREWS
FLUTED SOCKET SET SCREWS
ZIP-GRIP SELF-LOCKING SET SCREW
HEXAGON SOCKET HEAD CAP SCREWS
only Setko socket screw products have this distinctive, unplated, blue-black color



Standard on most Setko socket screw products

Isothermal heat treating has been adopted by Setko as a standard on most standard and special socket screw products including; hex socket, fluted socket, and slabbed head set screws as well as hex socket cap screws. (Stainless steel screws are generally not heat treated.) Unless you specify otherwise, screws that you order in these primary categories, regardless of points, or locking actions, will be isothermal heat treated. It costs you nothing more for this bonus value extra.

Take the Setko "Look Test"

Compare the unplated finish of Setko socket screws with other products using other methods. You'll see the cleaner, scale-free threads, heads and points that have made Setko socket screw products outstanding in their field. Write for test samples. Send us your specifications and requirements for advantageous quotations.

Isothermal heat treating minimizes distortion

You get low cost, more dependable performance on the production line and in the field — Isothermal heat treated screws have a minimum of distortion. Far less than commonly used methods. Screws fit better, hold tighter. It's the same heat treating method used by manufacturers of precision products such as: razor blades, etc. B-187

Setko engineers will reanalyze your socket screw product requirements

As a part of the continuing Setko program of product re-evaluation, Setko engineers will work with you in determining the best combinations of devices for your specific requirements. All you have to do is send a sample of the assembly with your specifications and they will make recommendations and suggestions, promptly and without delay. Take advantage of this offer today, you may realize substantial savings in increased reliability, lower production costs, or faster, easier assembly methods. Address requests on your company letterhead.

SETKO

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147 Main Street, Bartlett, Ill. (Chicago Suburb)

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Gasket engineering

INTERNAL PRESSURE vs. EFFECTIVE SEALING

Internal pressure creates two forces which can cause leakage in a gasketed joint. Proper flange design and correct selection of gasket materials can overcome these forces.

E. M. SMOLEY,
Research Physicist
Armstrong Research and Development Center

The pressure of confined liquids or gases acts against a gasket in two ways, as shown in figure 1.

1. Hydrostatic end force. This is proportional to the internal pressure and

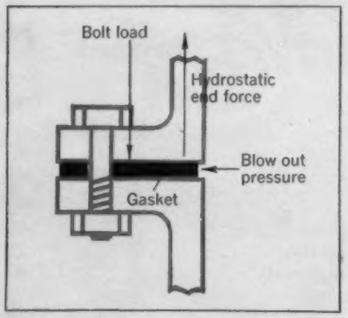

Figure 1. How internal pressure acts on a gasketed joint.

tends to move the flanges apart. As this occurs, the load on the gasket is reduced and leakage can result.

2. Blowout pressure. The sealed liquid or gas exerts direct pressure on

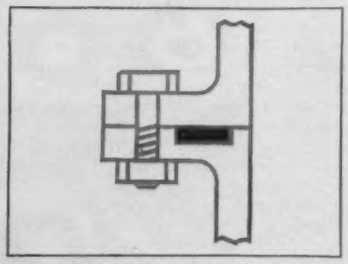

Figure 2. Flange design which confines gasket helps minimize blowout pressure.

the inside perimeter of the gasket. If this pressure is high enough, it will force the gasket out of the joint and leaks will occur.

These forces are usually associated with relatively high internal pressures. Studies at Armstrong Research and Development Center show, however, that pressures substantially less than 100 psi can cause leakage in some assemblies. (The Deflectometer shown in figure 3 is one tool used by Armstrong research engineers to measure flange deflection caused by internal pressure.)

Where internal pressures are involved, it is especially important to consider the joint as a unit. The flange design, the gasket material, and the temperature at the gasket line should all be considered in relation to each other.

The obvious first step is to be sure that flanges are sufficiently rigid to impose the required unit load on the gasket. The number of bolts, their size, their spacing, and their torque values are other factors related to flange loading which must be considered.

The second step is the evaluation of the gasket material to be used. High unit loads dictate the choice of a material that will not extrude or rupture under high pressures. This usually means a dense cellulose fiber or asbestos fiber material.

Several compositions suitable for service under high flange loads are available in the Armstrong Accopac line of beater-saturated gasket materials.

Where a compressible material such as cork-and-rubber is to be used, a flange design which confines the gasket,

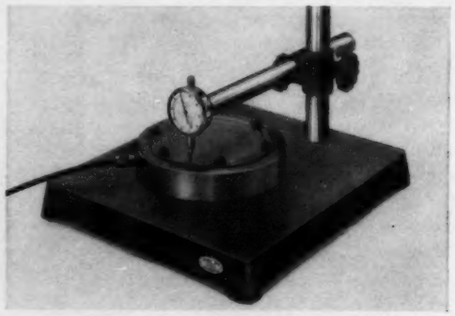

Figure 3. This Armstrong developed Deflectometer measures effect of 70 psi internal pressure in this stamped flange. Leak-producing deflections of .007" were detected at center point between bolts.

as in figure 2, will also help overcome blowout pressure.

A more complete discussion on the effect of internal pressure and other problems of gasket design, selection, and performance is included in the Armstrong Gasket Design Manual. Write today for your copy of this 32-page book. Address Armstrong Cork Company, Industrial Division, 7104 Ithaca Street, Lancaster, Pennsylvania.

Armstrong GASKET MATERIALS

SEEN AND HEARD

By Lars G. Soderholm, Midwest Editor

BUSINESS AROUND TOWN

Chicago has been placed on the list of distressed areas because of an unemployment figure of a little over seven percent. However, from information I've picked up while traveling around this area and other parts of the Midwest, economically, things have vastly improved over the past few months. Most companies seem to be in a better position saleswise and most of them also are doing more ordering than they have done in the past few months. Generally, the profit picture is down from what they would like it to be, but they still are very much in business. As a final clincher, the automobile dealers that used to call every couple of days about a month or so ago have calmed down a great deal —even though I haven't bought my new car yet. They all say their cars are moving much better now that spring's here.

LOOK FOR . . . .

a rash of new hydrostatic transmissions and for hydraulic components larger and more capable than anything previously available on the market. Everyone seems to have a hydrostatic transmission in the development stage at this time and some of them are extremely interesting. Also, high-volume, high-pressure hydraulic motors with low output speeds are in the offing, complete with pumps of the necessary capacity to supply them.

There are many segments of industry that could keep a close eye on these new developments. It is well known that the cost of a motor and set of speed reducers can amount to a large percentage of the cost of equipment. Fluid motors, because of their small size, can easily be mounted on many machines to reduce size, weight, cost and clutter. Also, in multiple installations it is sometimes possible to use a single power unit to supply a series of fluid motors, again at a substantial savings in cost.

Watch for several of these new units this spring and summer.

PLASTICS FOR PRODUCTION

A few days ago I met a designer in the electrical equipment field with a long memory. He referred to a paragraph in one of my old Seen and

Heard columns entitled "Plastics—Cheap?" He said plastic components were definitely the road to lower-priced electrical components. "Objections to plastic parts," he went on, "are the result of misapplication of materials. The solution is not the junking of plastics, but a better educational program for the designers and engineers and a better testing and control program for the development lab."

Companies that have had the best luck with plastics apparently are the ones that have spent the most time in initial research and more time with their suppliers.

ONLY A CODE OF ETHICS?

I recently talked to a design engineer for a large manufacturer of automotive components about engineering societies and what they offered their members. My friend was a little bitter about one organization which, as he put it, "gave me a code of ethics and expected me to reform my employer." Unfortunately, the engineer, upon accepting a job in industry, also accepts the ethics of the company he works for along with the terms of his employment. But again, as my friend said, "I'm not lazy, I just can't afford my own computer and test lab." These are "tools of the trade" his employer now furnishes.

Most engineers, designers or other engineering department personnel aren't interested in fighting the company. They would prefer to receive due credit for their contributions to the organization (both publicly and financially) and let it go at that.

Engineers can't remake industry to suit their convenience, but they can gain both in stature and in demand when they more fully demonstrate their knowledge and ability to understand and solve industry's engineering problems in a professional manner. Confidence in the engineer is the thing that most of our engineering societies could concentrate on teaching to both the general public and company management. And a service they could render the engineer would be to instruct him in the obligations he is expected to assume in meriting and retaining this confidence.

New from Du Pont—

FABRICS COATED WITH

VITON®

A synthetic compound that resists abrasion, corrosion, oils, solvents, temperature extremes

There are new opportunities for coated fabrics when durable "Viton"* synthetic rubber is combined with fabrics of glass, "Armalon"* TFE-fluorocarbon resin-coated glass, "Dacron"* polyester fiber, or "Teflon"* TFE-fluorocarbon fiber.

For example, a glass fabric coated with "Viton" and laminated to Refrasil fabric ("Fairprene"* 85-002) for use as a missile screen, when exposed for 60 seconds to 5700°F., 1½ inches from the surface, shows only slight charring of the Refrasil and practically no effect on the "Viton" coated glass which forms the alternate side of the laminate. "Viton" maintains its elastomeric properties despite this heat...can also withstand temperatures as low as minus 40°F., in gauges up to .020", without cracking.

An "Armalon" fabric coated on one side with "Viton" has proved promising as a tubing for transporting corrosive gases. These tubes can be heat-sealed on the "Armalon" side, with "Viton" on the outside, assuring excellent resistance to heat and chemicals as well as low permeation loss of the gases.

Fabrics coated with "Viton" are available for experimentation, test runs, or full-scale production operations. Contact your nearby Du Pont "Fairprene"* representative for complete information, or send coupon at right for literature and information.

*Du Pont registered trademarks.

PHYSICAL PROPERTIES OF FABRICS COATED WITH "VITON"

	86-007	85-001	84-001
Description: Polymer / Fabric	"Viton" A / "Teflon"	"Viton" A / #116 Glass	"Viton" A / "Dacron"
Properties: Gauge	.020"	.011	.008"
Wgt., Oz. /Sq. Yd.	22	15	9
Tensile Strength Strip, Lbs./Inch, W x F	77 x 73	117 x 90	81 x 70
Tear Strength Trap., Lbs. W x F	16 x 13	1 x 1	2 x 3
Abrasion Resistance 1 Lb. Edgewear Strokes	10,000	10,000	10,000
Burst Strength, Mullens, PSI	168	172	158
Gehman Stiffness T10° °F.	3°	3°	3°

*Temperature at which it is 10 times as stiff as at 77° F.

Du Pont Industrial Coated Fabrics

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E. I. du Pont de Nemours & Co. (Inc.)
Fabrics Sales, Dept. DN-14, Wilmington 98, Delaware.

Please send literature on fabrics coated with Du Pont "Viton" synthetic rubber.

*Name*_____ *Position*_____

*Company*_____

*Address*_____

*City*_____ *Zone*_____ *State*_____

Circle 6 on Reader-Service Card for more information

DESIGN NEWS SPECIAL REPORT

Silicone Rubber for Seals, O-Rings and Gaskets

Victor W. Wigotsky, Eastern Editor

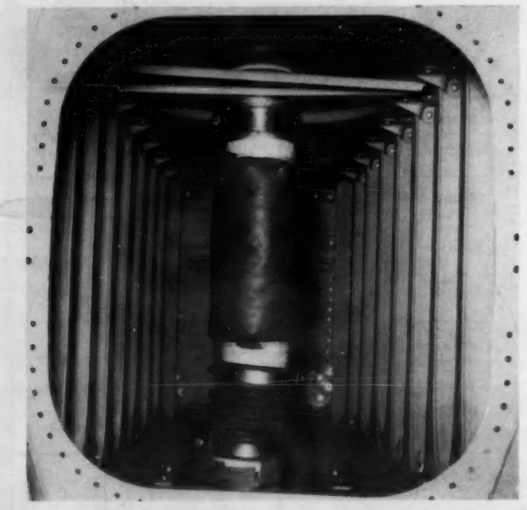
Silicone rubber can be used for seals, O-rings and gaskets wherever operating conditions require the following characteristics:

1. Good retention of elastomeric properties and flexibility when exposed to temperatures of 500F constantly and up to 600F intermittently. These are often measured in terms of hardness, tensile strength and elongation.
2. Flexibility without cracking when exposed to temperatures as low as minus 130F.
3. Good compression set characteristics (resistance to permanent deformation under compression at elevated temperatures).
4. No loss of resiliency or other properties when exposed to normally deteriorating effects of weather, sunlight, corrosive industrial atmospheres or oxidation of storage.
5. No cracking or checking in ozone atmospheres or near corona-producing electrical equipment.
6. Good dielectric properties which remain relatively unchanged over the minus 130 to plus 500F temperature range. Included in these properties are dielectric constant, power factor and electric strength.
7. Good immunity to water and humidity.
8. Little effect on physical and electrical properties by a variety of chemicals, oils and fluids. Special fluorosilicone compounds are available for resistance to solvents, jet fuels, and rubber-deteriorating oils.

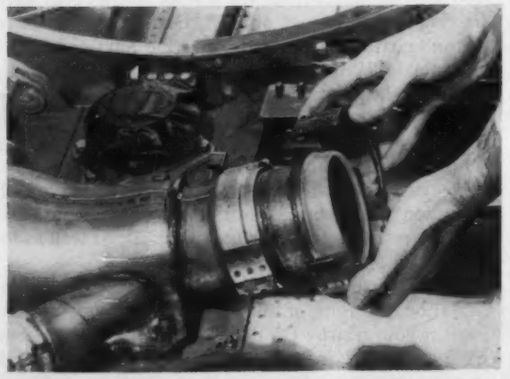
Silicone rubber has physical characteristics comparable to other elastomers at room temperature and retains these characteristics over the minus 130 to plus 500F temperature range. It is a naturally adhesive (non-sticking) material. This often simplifies installation or removal of parts.

Types Available

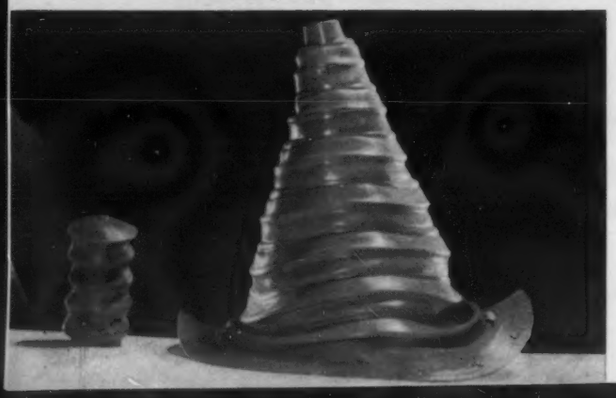
Extruded Seals: Available in a wide variety of sizes and shapes, either hollow or solid center. Special extrusions are available with sponged silicone-rubber cores.



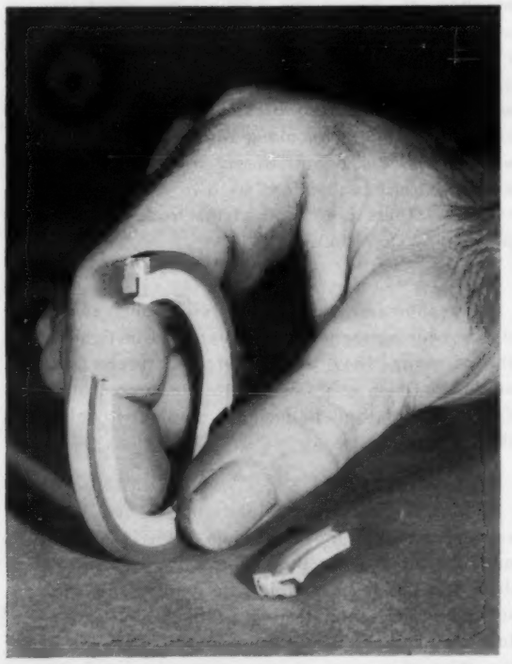
AIRCRAFT HOT AIR DUCT is made of glass cloth, reinforced with silicone rubber. Flexible connectors are made of same material. Ends are sealed with liquid silicone rubber. Service range is from minus 120 to plus 600F. Unit resists common aircraft fuels and lubricants, has low compression set and will not "cold flow" away from clamps.



SILICONE-RUBBER SEAL is shown on one of three duct connectors joining hot air lines from icing system. Seals must withstand high engine heat and constant pressure from retaining rings.



TEMPERATURE-RESISTANT SILICONE BELLOWS are used to seal dust and moisture out of helicopter mechanisms. Large bellows seals around joy-stick and small unit around rotor mechanism.



SHAFT AND BEARING LUBRICANTS caused original seals to swell and subsequently pull away from shaft. Warping made it necessary to install new seals every time units were disassembled. Silicone-rubber assemblies are still in such excellent condition after 500 hr of operation that they can be reassembled with ease.

LIQUID SILICONE RUBBER, which cures at room temperature, is used to seal wing leading-edge interiors (above), hot air ducting and around radome.

CYLINDER HEAD GASKET GROMMETS made of resilient silicone-rubber rings are positioned over entrances to coolant passages in top of block. Grommets snap into gasket where they remain flexible and sure-sealing, despite attack by cooling fluids and engine temperatures in 300 to 350F range.

SILICONE RUBBER SELECTOR
(molded, extruded and calendered parts)

FOR THESE APPLICATIONS	IN THIS TEMP. RANGE[a]	USE SILICONE RUBBER CLASS	TYPICAL PROPERTIES[b, c]									YOU CAN SPECIFY BY			
			Hardness, Durometer (Shore A)	Tensile Strength psi	Elongation percent	Tear Resistance lb/inch	Compression Set, percent 22 hrs/300F	Brittle Point deg F	Heat Stability Hardness Change 70 hrs/450F	Oil Resistance Vol. Increase percent ASTM No. 1 70 hrs/300 F	Density lb/cu inch	AMS	ASTM	MILITARY MIL-R-3065 (MIL-STD-417)	MILITARY MIL-R-3647
O-rings, gaskets and seals in lubricating, hydraulic and pneumatic systems. Engine parts.	–75 to to +450F in severe compression	Low Compression Set	50	900	200	40	10	–85	+5	+7	0.043		TA504B		
			50	1000	400	80	15	–90	+5	+7	0.043		TA505B		
			60	750	90	40	10	–85	+5	+7	0.045				
			60	900	130	65	10	–90	+0	+6	0.043	3303	TA604B		
			70	800	80	40	15	–85	+5	+5	0.048		TA704B		
			70	1000	120	70	12	–90	+0	+5	0.045	3304	TA704B		
			75	1000	180	85	15	–85	+3	+7	0.047	7267	TA706		Class II, 70 duro
			80	900	60	40	18	–85	+5	+5	0.051		TA805B		
			80	1100	80	75	15	–90	+0	+5	0.048	3305	TA805B		
Low-pressure gasketing, closures, diaphragms, shock mounts, boots, bellows, sleeves, bushings, etc. General uses where specific properties of other classes are not needed.	–75 to +500F in vented systems	General Purpose	40	1000	500	75	20	–85	+5	+7	0.041	3301		TA405	Class II, 40 duro
			50	750	300	50	50	–83	+10	+7	0.042		TA505		
			50	1000	400	80	20	–83	+5	+7	0.043		TA507	TA505	Class II, 50 duro
			60	900	250	65	18	–85	+2	+7	0.043	3356	TA604 TA606	TA605	Class II, 60 duro
			75	1000	180	85	15	–90	+3	+7	0.047	7267	TA704		Class II, 70 duro
			70	900	300	100	30	–85	+5	+8	0.043	3357	TA706	TA705	Class IIA, 70 duro
			80	800	200	120	35	–90	+5	+7	0.044		TA805		Class IIA, 80 duro
			80	1100	300	125	25	–85	+5	+7	0.044		TA806	TA805	Class IIB, 80 duro
Airframe and missile parts: bomb bay, entry and cargo door seals, window and canopy seals, boots, bellows, diaphragms, fanning blankets.	–150 to +500 F in vented systems	Extreme Low Temperature	25	1000	600	100	20	Below –150	±5	+10	0.040	3332			Class III, 25 duro
			25	1000	800	100	20	Below –150	+2	+10	0.043	3332			Class III, 25 duro
			40	1000	500	125	20	Below –150	±5	+9	0.041	3334			Class I, 40 duro
			50	1000	300	75	45	Below –150	+5	+9	0.045	3335			Class I, 50 duro
			50	1500	600	200	50	Below –150	+10[d]	+10	0.043	3345			Class III, 50 duro
			60	900	200	65	20	–150	+5	+9	0.045	3336			Class I, 60 duro
			60	1400	600	200	40	–150	+6[d]	+10	0.044	3346			Class III, 60 duro
			70	1400	600	130	30	Below –130	+5	+10	0.050				Class I, 70 duro
			70	800	180	75	20	Below –130	+2	+12	0.046				Class I, 70 duro
			80	1200	300	130	50	Below –130	+10[d]	+10	0.048				Class III, 80 duro
Low-pressure and wide tolerance seals. Cushions, vibration mounts.			Compression–Deflection (psi to compress 25 pct)												
			Sponge, medium		8		20°	Below –120	–	–	0.010	3195			
			Sponge, firm		15		20°	Below –130	–	–	0.010	3196			
Oven and autoclave door gaskets, hot materials handling equipment, high-temperature electronic applications.	–75 to +600F in vented systems	Extreme High Temperature	40	1000	500	75	20	–85	24 hrs/600F +30	+7	0.041			TA405	
			50	800	200	50	40	–65	24 hrs/600F +25	+7	0.043				
			50	900	200	40	18	–85	+25	+7	0.043	3302	TA505	TA505	
			60	900	250	65	20	–85	24 hrs/600F +25	+7	0.043	3303			
Hot air ducts and hose.	–120 to +600F		50	Coated on glass cloth, properties are excellent.			25	–100	Excellent	Good	0.054			MIL-H-5796 (ASG) MIL-D-26124 (USAF)	
Supported tapes. Unsupported tapes.	–105 to +600F –65 to +600F		50	900	450	85	20	–105	Excellent	+10					
			50	850	500	85	20	–85	Excellent	+10					

[a] Upper temperature limits shown above apply to vented systems only. In sealed systems somewhat lower temperatures apply.
[b] Properties shown are typical and not guaranteed minimums. Some variation in properties may be expected due to specific product grade and oven cure used.
[c] Some silicone rubber compounds are colored during their manufacture; others are neutral in color and may be tinted as desired by rubber fabricators.
[d] 70 hours/400 F
[e] 22 hours/158 F

Molded Seals and Gaskets: Used when dimensions and cross-section accuracy are critical. In many cases, the same molds normally used for rubber parts can be used for silicone rubber.

Combination Extruded and Molded: For large diameter or extremely long seals. Sections of seal are first extruded and then placed in a mold and the ends spliced. This technique lowers mold costs and speeds production time.

Fabric Reinforced Seals: Glass and other fabrics are extruded or molded into a seal as it is produced or are wrapped around the seal after it is completed. Silicone-rubber pastes are used to bond fabric to seal. Fabric increases abrasion and tear resistance of seal.

Molded O-Rings: Usually made in same way and with same equipment as regular O-rings. Parts resistant to oils, fuels and solvents are made with special solvent-resistant silicone-rubber compounds.

Flat Gaskets: Sheets of solid silicone rubber are die-cut or punched. Thickness ranges from 0.005 to 1.5 inches.

Fabric-Reinforced Flat Gaskets: Addition of fabric reinforcement increases tear resistance. Fabric can be added to either side, both sides or in center of gasket. Extra thick gaskets are built up by using several laminations of fabric and rubber. Solvent resistant or regular grades of silicone rubber can be used.

Combination Gaskets and Seals: Silicone rubber is combined with cork, metal and other inorganic fillers to make gaskets that meet special requirements. Combining materials makes use of most important properties of each.

Properties

Various combinations of basic silicone-rubber compounds, fillers, catalysts, curing cycles and fabrication techniques can emphasize one or more properties to meet particular operating conditions.

Thermal Stability: Probably the single most important property of silicone rubber is its stability at temperature extremes. Seals, O-rings and gaskets can be fabricated that will retain rubberlike properties over the minus 130 to plus 500F range. Special compounds extend low temperature brittle point below minus 160F and upper operating limit to more than 600F.

Tensile Strength: Ranges from 500 to 1500 psi for unsupported silicone-rubber parts. This depends upon type of compound, filler, catalyst, curing schedule and fabrication technique. Tensile strength of fabric-reinforced parts is usually that of the fabric.

Tear Strength: In general, values up to 200 lb/in can be obtained. Tear strength of reinforced parts is dependent upon fabric and design.

Elongation: Non-reinforced silicone-rubber seals, O-rings and gaskets have elongation values ranging up to 800 percent. Elongation values for fabric-

(Continued on next page)

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. . . for super carrier Enterprise.

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Safety underfoot on the U.S.S. Enterprise is assured by A.W. Super Diamond floor plate. Built by Newport News Shipbuilding and Dry Dock Co., the Enterprise is truly a super-ship—the world's first atom-powered aircraft carrier . . . the largest ship afloat . . . with the most powerful nuclear plant on land or sea . . . bringing together the greatest amount of electrical and electronic gear ever assembled in such a compact space. And super-safety matched to this super-ship concept is provided by A.W. Super Diamond underfoot!

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Silicone Rubber . . . Cont.

CHEMICAL AND FLUID RESISTANCE OF SILICONE RUBBER COMPOUNDS

All results refer to volume swell at room temperature, unless a high temperature is specified. Special compounds may be available for specific uses.

Good = Less than 10 percent swell
Fair = 10 to 25 percent swell
Poor = Over 25 percent swell

	Resistance
Acids	
Acetic, 5 percent	Good
Acetic, Concentrated	Good
Hydrochloric, 3 to 10 percent	Good
Hydrochloric, Concentrated	Good – Fair
Nitric, 10 percent	Good
Nitric, Concentrated	Poor
Sulfuric, 10 percent	Good
Sulfuric, Concentrated	Disintegrates
Bases	
Ammonium Hydroxide, 10 percent	Good
Ammonium Hydroxide, Concentrated	Good
Sodium Hydroxide, 10 percent	Good
Sodium Hydroxide, 20 percent	Good
Salts	
Sodium Carbonate, 2 percent	Good
Sodium Chloride, 10 percent	Good
Solvents	
Acetone	Fair
Carbon Tetrachloride	Poor
Diethyl Ether	Poor
Perclene, Triclene	Poor
Ethyl Alcohol	Good
Butyl Alcohol	Fair
Methyl Ethyl Ketone	Poor
Gasoline	Poor
JP–4	Poor
Mineral Spirits	Poor
Toluene	Poor
Ethylene Glycol	Good
Miscellaneous	
Liquid Ammonia	Good
Freon 12, 114	Poor
Sulfur Dioxide	Good
Methyl Chloride	Poor
Methylene Chloride	Poor
Water	Good
Hydrogen Peroxide, 3 percent	Good
Perspiration, Body Acids	Good
Oils	
ASTM No. 1 (SAE No. 10) at 350F.	Good
ASTM No. 3 at 300F.	Poor
Diester Oils (MIL–7808 Type)	
Room Temperature	Fair
350F.	Poor
Silicate Base Hydraulic Fluid	Poor
Chlorinated Transformer Oil (Askerol)	
Room Temperature	Good
350F.	Fair
Petroleum Base Transformer Oil	Poor
Tricresyle Phosphate	Good
Castor Oil	Good
Mineral Oil	Good
Silicone Oil – 30,000 cs and up	Good
Silicone Oil – under 30,000 cs	Poor
Arochlor (Chlorinol Biphenyl)	
Room Temperature	Good
300F	Good

reinforced parts are governed by the fabric. Bias-cut fabrics will allow moderate elongation.

Compression Set: If compression set is high, the parts may not be reusable or may fail after short operation. Silicone-rubber parts have compression set values ranging from 10 to 70 percent. Here, as with other properties, the value can be controlled by selection of basic rubber compound, filler, catalyst, cure schedule and fabrication technique.

Hardness: Available in hardnesses ranging from 20 to 90 durometer. Most frequently used grades are from 50 to 80 durometer.

Oil and Chemical Resistance: Silicone rubber resists attack by most alkalies, diluted acids and 90 percent hydrogen peroxide. It will, except in special compounds, swell in contact with aromatic solvents and silicone oils. It is therefore advisable to test silicone-rubber seals, O-rings and gaskets under actual operating conditions when oils, solvents and chemicals are involved. If possible, all testing should be done under dynamic rather than static conditions. Frequently, solvent-resistant silicone rubber can be used for applications involving chemicals and oils that attack regular silicone rubber.

Ozone and Corona Resistance: Relatively unaffected by corona or heavy concentrations of ozone. Can be used at high altitudes and on high-voltage equipment without deterioration.

Moisture Resistance: Silicone rubber absorbs from less than one to four percent water, even when totally immersed 70 hr at 212F. This property is of particular importance in seals and gaskets that are exposed to the elements.

RTV Compounds

Room-temperature vulcanizing silicone rubbers are also available in consistencies from easily pourable to stiff paste. They cure to the consistency of rubber at room temperature after addition of a catalyst. An RTV compound is also available which does not require a catalyst for use and is simply squeezed into place from a tube. These compounds suggest use as a seal material that can be either molded into desired shape, applied with a caulking gun, a spatula or even poured. With application of a primer, they can be bonded to a surface, yet exhibit excellent release properties relative to associated components. These materials possess all the characteristics of conventional heat-curing silicone-rubber compounds, except that their physical properties are slightly lower.

Data courtesy of Union Carbide Corp., New York, N. Y., General Electric Co., Silicone Products Dept., Waterford, N. Y., and Dow Corning Corp., Midland, Mich.

Ingersoll-Rand solves pumping headaches . . .

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In 100 years of pump manufacture, Ingersoll-Rand has solved many problems for machinery builders. For an economical solution to your liquid moving problems, call for the pump specialist at your nearest I-R branch office — or write direct to our New York headquarters. If we can't meet your requirements from our many standard models, we will engineer a unit just for you.

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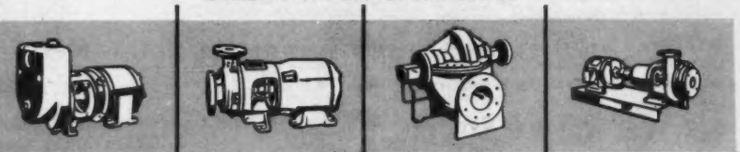
OTHER I-R PUMPS AVAILABLE



Self-priming pumps | Motorpumps | Horizontally split pumps | Cradle Mounted pumps

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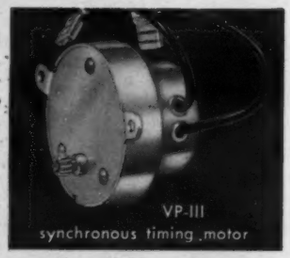
What's so uncommon

about this timer... or this one?

VC-300
variable-cam timer

GT-100
general-purpose timer



VP-III
synchronous timing motor

What's uncommon about these timers? It's the *motor*, the heart of any timing device, which is common to both. *Uncommon* because it is uniquely adaptable to unusual configurations. The VP-III motor offers extra reliability, too — with positive lubrication, heavy-duty gear train, and variable pole rotor. In addition to these versatile, reliable motors, other features of Lake-City timers merit careful consideration. The VC-300 variable-cam, for instance, is the only one made of corrosion-resistant *aluminum*. Less wear. Easier to adjust. VC-300 timers are available with up to ten 25-amp. circuits . . . for timing cycles from five seconds to several days. Or consider the GT-100 general-purpose timer — a single-circuit "work-horse" for anything from signs to systems. Speeds from 1/60 to 10 rpm, with 25-amp. DPDT or SPDT switch. Lake-City's VC-100 and VC-200 single-circuit variable-cam timers, too, use motors from the VP-III family.

Isn't there a product you could be improving . . . or a new idea you might be developing — right now — with these advanced motors or timers? Write for full information.

LAKE CITY, INC.
A SUBSIDIARY OF CONTROLS COMPANY OF AMERICA
CRYSTAL LAKE, ILLINOIS

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DESIGN IDEAS NEWS

MECHANICAL

Redesigned Outboard-Motor Drive

Lars G. Soderholm, Midwest Editor

An outboard-motor lower drive unit has been redesigned for high performance by changing the bearings and their mountings and by reducing the gear ratio.

In order to obtain high performance, the standard outboard-motor lower unit was analyzed to determine what improvements could be effected to increase its efficiency. It was decided to redesign the unit to reduce the frontal area for less drag. Also the stock 16:25 gear ratio was changed to a 17:19 ratio to get a higher top speed. A smaller-diameter, high-pitch propeller is used.

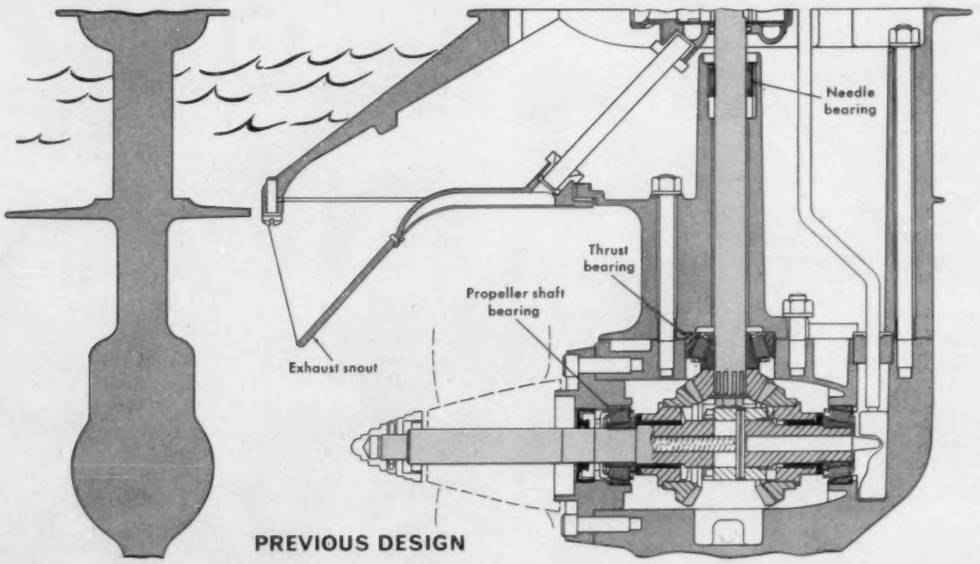
To reduce the frontal area, a slimming of the lower unit's housing was necessary. The tapered bearing located directly above the bevel gears, as well as the bearings at each end of the propeller shaft, cause a sizable bulge in the standard lower unit. Normally, at lower speeds, this bulge is not serious. However, to squeeze the utmost from the power unit, it was decided to try to eliminate as much as possible of this drag area.

This was done by moving the thrust bearing on the drive shaft into a higher position above the water line. A needle bearing is used to insure proper alignment of the lower portion of the drive shaft. Smaller-diameter bearings also are used at both ends of the propeller shaft.

By moving the thrust bearing to its higher position, the housing split in the new high-performance lower unit is much higher than on the standard units. In addition, the exhaust snout is widened and shaped so that it will not dip so deeply into the water for reduced drag.

Preliminary test work has shown that the new design has reduced drag up to 43 percent. This is reflected by a 23 percent increase in speed over that with the standard lower unit. The design engineers indicate the redesign for high performance is most noticeable at high speeds. They suggest that if a boat owner's present boat is not capable of 40 mph or better, switching to the new high-performance lower unit would not result in the high efficiencies for which it was designed.

The "Sportsman" lower unit was designed by the Marine Products Div. of the McCulloch Corp., Minneapolis, Minn.



PREVIOUS DESIGN

PREVIOUS LOWER-UNIT DESIGN has thrust bearing directly above bevel pinion gear. Needle bearing located higher up in housing helps maintain shaft alignment. Propeller shaft is held by two tapered bearings. Exhaust snout dips into water quite deeply as shown. Tapered bearings, because of their large OD, required substantial bulge in lower unit casting. This contributed to high frontal drag at top speeds.

Reduces Drag, Improves Performance

REDESIGNED LOWER UNIT has thrust bearing moved into higher position on drive shaft. Needle bearing is in position directly above bevel pinion. Tapered roller bearings have been replaced by smaller-diameter ball bearings. Exhaust snout in new design has been flattened and lifted into higher position. New-design lower unit uses positive spline-follower clutch against detent-type cam and follower shift mechanism in standard unit.

New adjustable differential pressure switches

- **Accurate: reproducible within 1% of setting in many ranges**
- **Small: 3" x 2" (approx.)**
- **Light-weight: made of precision-machined aluminum and stainless steel (other materials available)**
- **Vibration-resistant: withstands frequencies up to 2000 cycles/second**
- **Leak-proof: no mechanical linkages; no moving seals**
- **Performance-proved: related units of this type in operation over 4 years in critical airborne and industrial installations**

See Deltadynes at Design Show Booth #960

This amazing switch, useful for pressure or differential pressure, combines advantages and economy not previously available in fluid system warning devices. Pressure may be adjusted in the field on a direct-reading dial. At set pressure, switch actuates to sound alarm, light bulb, turn motor on or off, or operate valve—in place or at remote panel board. Most models are not damaged by overpressures up to rated working pressure.

WRITE FOR LITERATURE

0.25" to 16" of water column, 250 psi working pressure—BULLETIN E7
0.125 to 16 psid actuation, 250 psi working pressure—BULLETIN E8
15 to 200 psid actuation, 5000 psi working pressure—BULLETIN E9

PALL

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TRANSFER MACHINE BUILT BY BUHR MACHINE TOOL CO., ANN ARBOR, MICHIGAN

Automated GIANTS like this

REQUIRE STRONG HYDRAULIC *HEARTS* EVERY MINUTE OF THEIR WORKING LIFE

24 RACINE PUMPS *operate this 58 station 500-ton transfer machine*

The precisioned flow control of RACINE PUMPS assures the split-second timing and efficiency required to operate this complex Buhr Transfer Machine . . . custom-built for the completely automatic machining of 120 auto-cylinder heads hourly for a leading automotive manufacturer. Compact RACINE VALVES control feeds and reverse movements on all 323 operations performed by the machine. RACINE 4-WAY SOLENOIDS help one man operate this mechanical giant. Buhr has used RACINE PUMPS and Reservoir Units on custom-built machines for the automotive industry for over 10 years.

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RACINE, WISCONSIN
HYDRAULICS DIVISION

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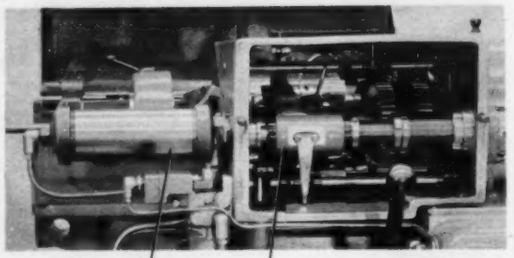
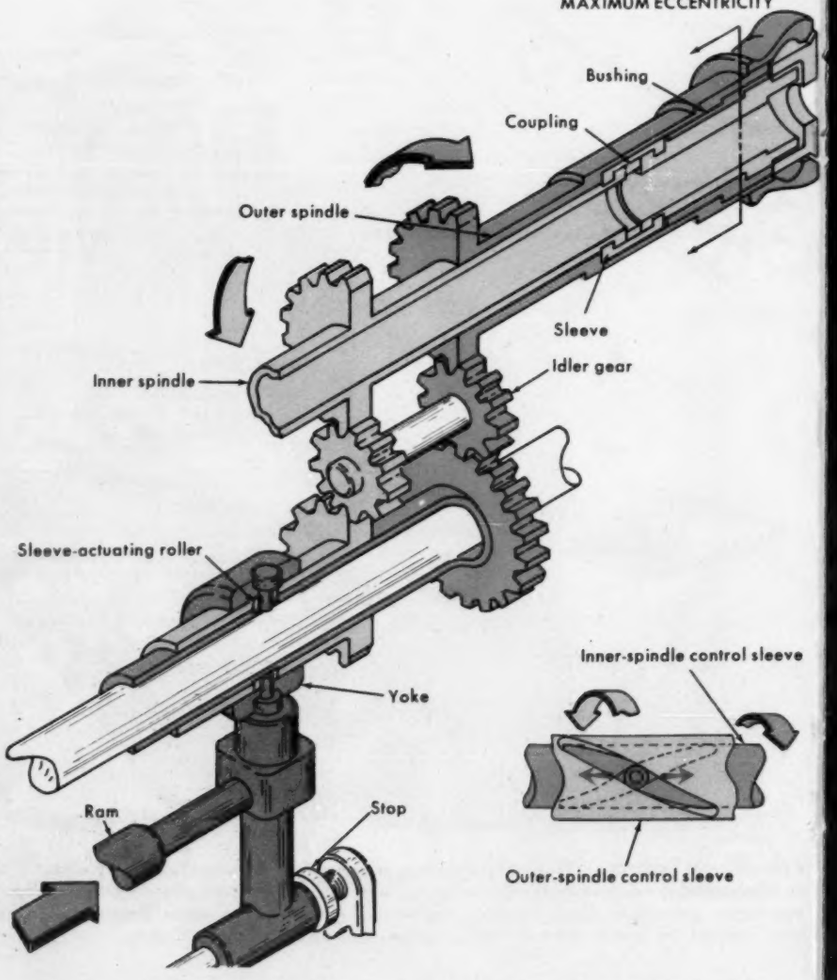
Ram-Actuated Scrolled Sleeves Control

Ronald W. E. Martin, British Editor





Spindle Eccentricity

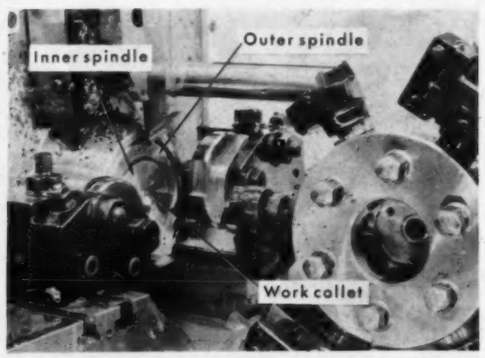
A train of gears, operated by two opposite rotating scrolled sleeves, rotates the inner and outer members of a work spindle to obtain eccentric setting. Embodied in a single-spindle automatic machine, the mechanism avoids releasing the work-holding collet and reversing the spindle when carrying out this setting operation.

In the new arrangement, the work spindle embodies two separate spindles arranged one inside the other. Main outer spindle has an eccentric bushing held rigidly in position by pegs. Inner spindle is in two parts, secured by a form of flexible coupling. Front portion has an eccentric bore and is itself eccentric to the outer spindle; rear part is concentric to the outer spindle. Arrangement permits inner spindle to rotate freely within the outer spindle.

Actuating system comprises two scrolled sleeves, one inside the other, with gears connecting each sleeve to its respective spindle. Two diametrically opposed scrolls are cut in the outer sleeve. The inner sleeve has two opposite scrolls.

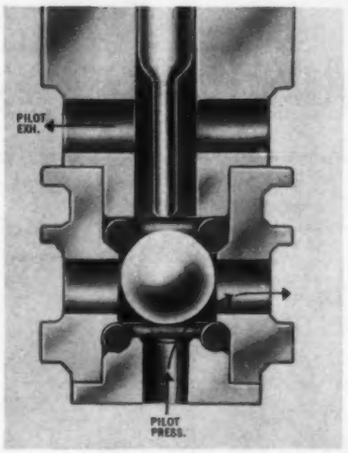
The scrolls of one sleeve are coupled with those of the other by rollers positioned diametrically opposite in a sliding collar. Longitudinal movement of this collar is effected by a ram-actuated yoke. This movement revolves sleeves in opposite directions by passage of the rollers along scrolls. Resultant rotary movement is transmitted to the spindle through gear trains.

The single-spindle automatic was designed by B.S.A. Tools, Ltd., Birmingham, England.



ECCENTRIC-CONCENTRIC MECHANISM enables workpiece to remain clamped while making adjustments. Spindle does not have to be reversed and attachment does not affect spindle speeds or direction of rotation.

How To Build An Air Valve That Beats Friction and Coil Heat



ENLARGED SECTION OF PILOT CARTRIDGE

To Achieve Endurance, a Breakthrough in Speed

Generally, the most unpredictable factor in solenoid valve life is the solenoid coil itself, and yet, a solenoid can be made to last practically forever if the coil can be kept from overheating. Coil heat is generated by long plunger travel and accelerated by erratic drag (friction) during that travel. Achieve a short, quick, sure plunger stroke and the coil will last indefinitely. Therefore, the life of a solenoid pilot air valve is directly related to speed of operation. To achieve operating speed, friction in the pilot section and solenoid plunger travel must be reduced to a minimum. Solve these problems and you get air control reliability that seems to have no limit.

The Call-Outs Tell the Story of Endurance

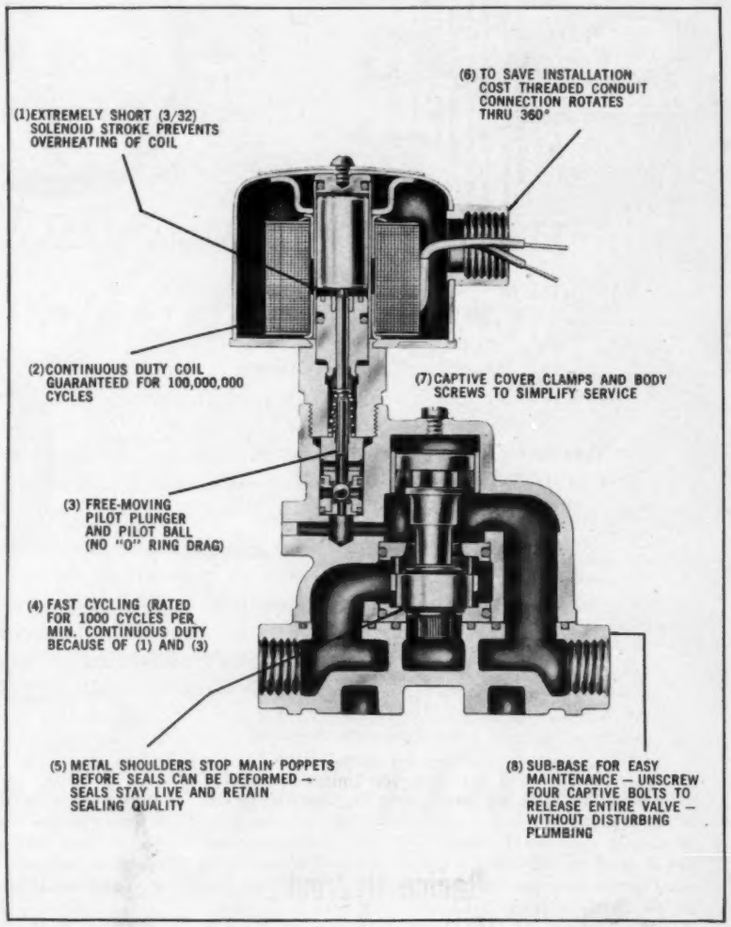
To control the major source of coil burnout, coil heating, the stroke of the solenoid plunger must be reduced to a minimum. The short stroke fractions the time the coil is energized; heat generation drops and response time of the valve is stepped up. In the "Mach 2" the stroke has been reduced to 3/32—about the thickness of a nickel. Furthermore, the friction problem must be solved, to avoid any unpredictable drag. In the "Mach 2" this has been done by use of a pilot cartridge enclosing a free-moving ball that seats on "O" rings at both ends of the cartridge [see above]. The ball moves freely, independent of the seals. There is no "O" ring drag on the pilot plunger as it requires no seals. When there is no friction there is no wear. Similarly, the main valve seats seal on "O" rings. In the sealed position, metal shoulders take the shock in such a way that the "O" ring seal is merely kissed by the main valve seat [see (5) below]. As the rings are only minutely flexed they do not fatigue or lose their resilience.

What about Cycling Speed?

Short solenoid plunger stroke and elimination of friction make extremely fast cycling feasible. After exhaustive testing in the laboratory and on industrial applications for over six years the "Mach 2" is rated at 1000 cycles per minute continuous duty. Cycling speeds as high as 2100 have been successfully reached for intermittent periods of twenty minutes. During a two-hour test at a sustained speed of over 1500 cycles per minute the coil temperature stabilized at 7°C below the maximum code limit for Class A coils.

100-Million-Cycle Guarantee on Solenoid Coils

The design advances incorporated in the CRESCENT® "Mach 2" Air Valve are a significant breakthrough in both cycling speed and operating dependability. Put CRESCENT® "Mach 2's" (¼- to ¾-inch pipe sizes) on your "valve killer" jobs and see how freedom from coil burnout helps to cut operating costs. Write for an advance copy of the new CRESCENT® "Mach 2" catalog to Barksdale Valves, 5125 Alcoa Avenue, Los Angeles 58, Calif.

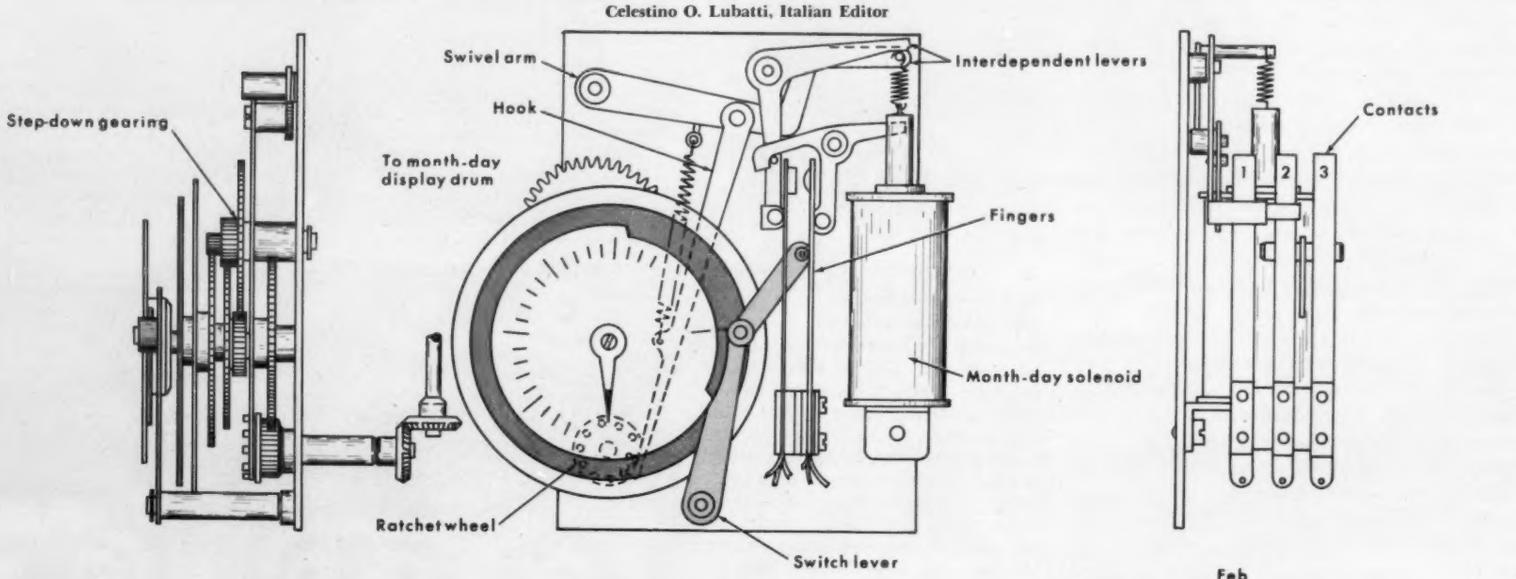

(1) EXTREMELY SHORT (3/32) SOLENOID STROKE PREVENTS OVERHEATING OF COIL
(2) CONTINUOUS DUTY COIL GUARANTEED FOR 100,000,000 CYCLES
(3) FREE-MOVING PILOT PLUNGER AND PILOT BALL (NO "O" RING DRAG)
(4) FAST CYCLING (RATED FOR 1000 CYCLES PER MIN. CONTINUOUS DUTY BECAUSE OF (1) AND (3)
(5) METAL SHOULDERS STOP MAIN POPPETS BEFORE SEALS CAN BE DEFORMED — SEALS STAY LIVE AND RETAIN SEALING QUALITY
(6) TO SAVE INSTALLATION COST THREADED CONDUIT CONNECTION ROTATES THRU 360°
(7) CAPTIVE COVER CLAMPS AND BODY SCREWS TO SIMPLIFY SERVICE
(8) SUB-BASE FOR EASY MAINTENANCE — UNSCREW FOUR CAPTIVE BOLTS TO RELEASE ENTIRE VALVE — WITHOUT DISTURBING PLUMBING

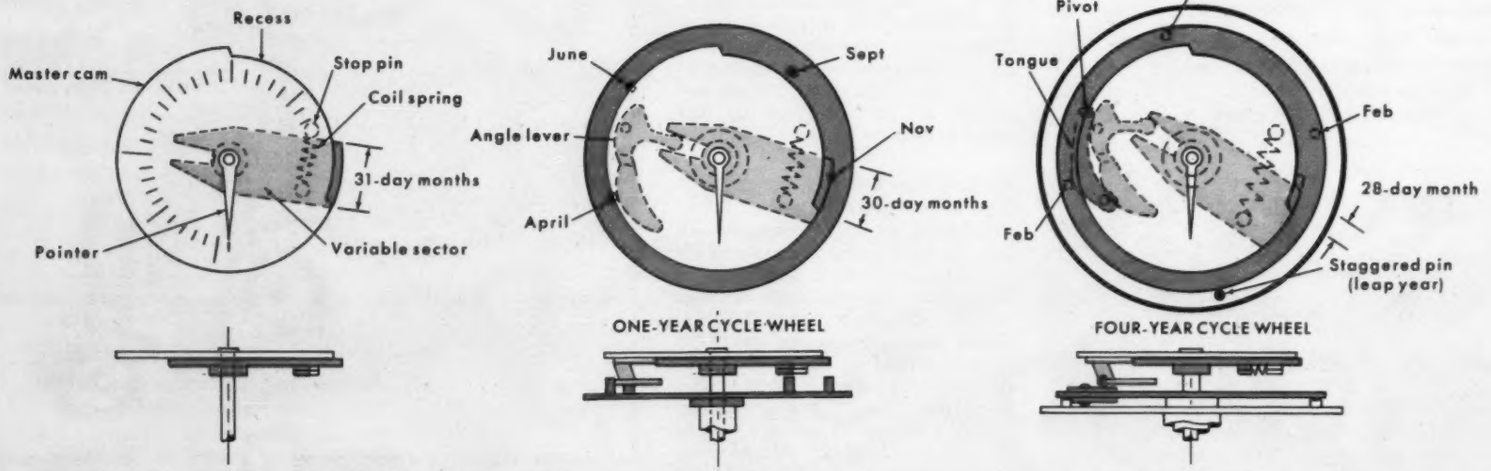
Circle 12 on Reader-Service Card for more information

Clock-Calendar Master Cam Adapts Itself to Length of Month

Simple mechanical and electrical systems combine to form a compact, perpetual clock-calendar

Celestino O. Lubatti, Italian Editor



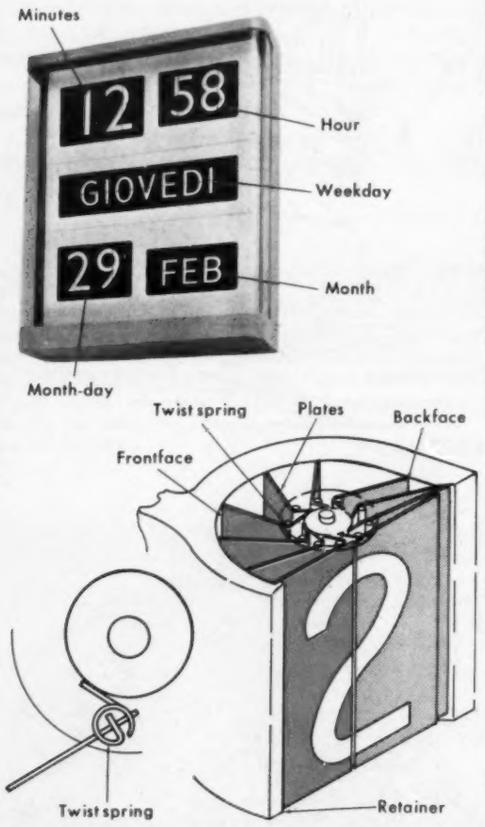


VARIABLE SECTOR is normally drawn against stop by coil spring to provide maximum extension (31-day months). Pins on one-year cycle wheel actuate angle lever, reducing extension of sector by one step for 30-day months. Four-year cycle wheel carries three pins for 28-day months and one staggered pin for 29-day leap-year February. These pins force tongue pivoted to one-year cycle wheel inward; angle lever swings back sector by three or two angular steps. Stationary pointer indicates current setting of master cam. On midnight switching of clock unit (not visible), electric impulse energizes month-day solenoid. Swivel arm engages hook with next tooth of ratchet wheel, allows hook spring contraction and ratcheting as solenoid is de-energized. Ratchet wheel drives month-day display drum and step-down gear train relative to master cam and pinwheels. When switch lever falls into master cam recess (end of month), flexible fingers close contacts 2 and 3 performing, respectively, month-name change and quick ratcheting of month-day unit. Interdependent levers (only partly visible) cause fast reciprocation of month-day solenoid and close contact 1 as master cam lifts switch lever again. Contact 1 energizes relay on clock to reopen main contacts.

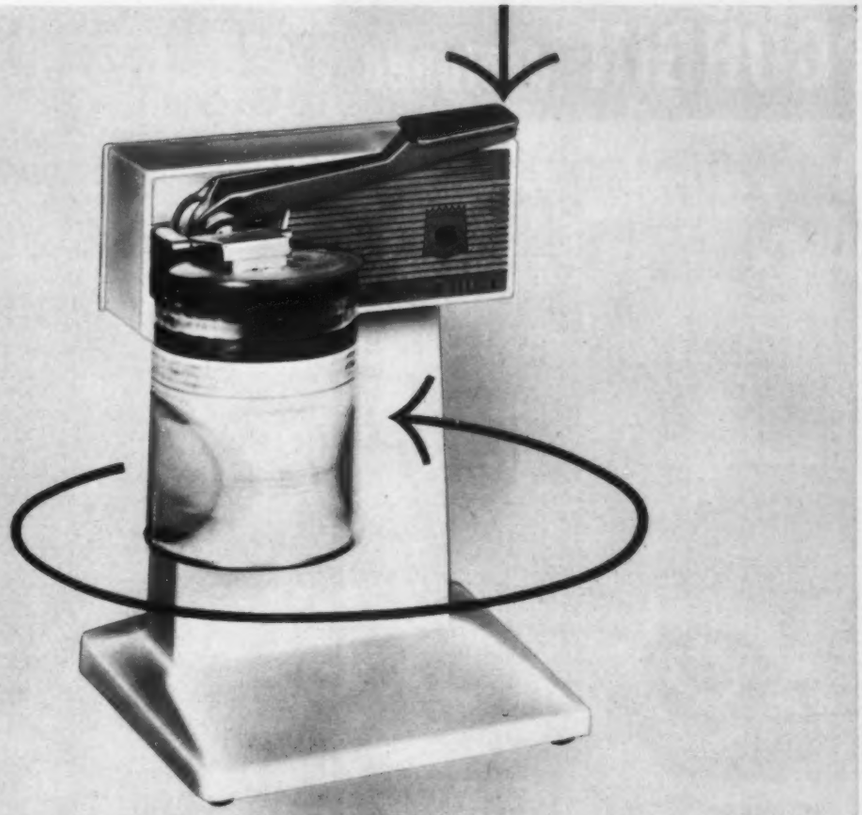
A rotatable sector varies the month-cycle master cam of a perpetual calendar to provide corrections with simple, mechanical means. Active sector extension is retracted automatically by one or more angular steps for all months of less than 31 days. A switch-lever master cam follower thus skips wasted motions to speed reset of day counter and indication of next month.

Very slow pinwheels correct variable sector position for 30-, 29-, (leap year) and 28-day months. This length-of-month control is ratchet-driven by a solenoid receiving electric impulses on midnights from the mechanically independent clock. The clock main shaft drives display drums for hour and minute digits. Cam-actuated ratchet mechanisms time various drums and calendar switching.

The calendar clock was designed and is produced by Solari & Co., SpA, Udine, Italy.



THREE SECTIONS for hour, weekday and month-day are mechanically independent to permit arrangement in vertical or horizontal row. Spring-loaded plates in display cages form large characters in limited space. Cages are vertical for digits and horizontal for weekday and month. Digit or word is written on front of one and back of preceding plate to avoid idling steps and/or blank surfaces. Electric diagram shows connection between clock and calendar sections. Main contacts 4 and 5 operate month-day and weekday solenoids on midnight.



Silent nylon gears drive new Sunbeam electric can opener

Manufacturers are often able to gain more than cost savings through the use of custom-molded plastic components. A good example is this new Sunbeam electric can opener. To obtain quiet, maintenance-free operation, custom molded nylon gears were used instead of metal. For appearance, strength and ease of cleaning, Tyril®, a rigid thermoplastic, was used for the housing and base.

Chicago Molded sales engineers worked closely with Sunbeam designers in the selection of Nylatron® GS nylon for the gear train because of its sound-deadening, wear-resistant and self-lubricating qualities. Tyril was selected because of its resistance to acids, soaps, and food stains. Through the combined engineering skills of both Sunbeam Corporation and Chicago Molded Products, it was possible to design and produce more efficient, less costly components that resulted in a superior, better selling end-product.

Send for new brochure "Design and Purchase of Custom Molded Plastics."

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ON LOCKERS

CABINETS

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MACHINERY

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WIDE SELECTION OF CAMS

VARIETY OF STYLES AND SIZES

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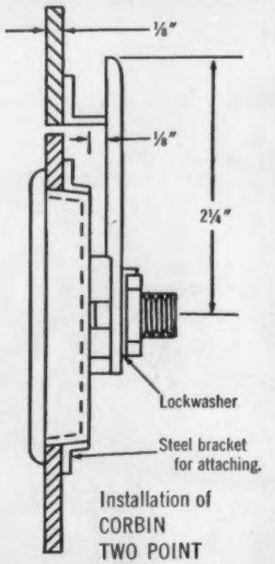


Installation of CORBIN TWO POINT FLUSH CATCH No. 2505 ¾

Attached by screws through sides of cup to steel brackets supplied by cabinet manufacturer.

CORBIN

CORBIN CABINET LOCK DIVISION

THE AMERICAN HARDWARE CORPORATION
NEW BRITAIN, CONNECTICUT

SINGLE POINT LOCKING OR USED WITH RODS

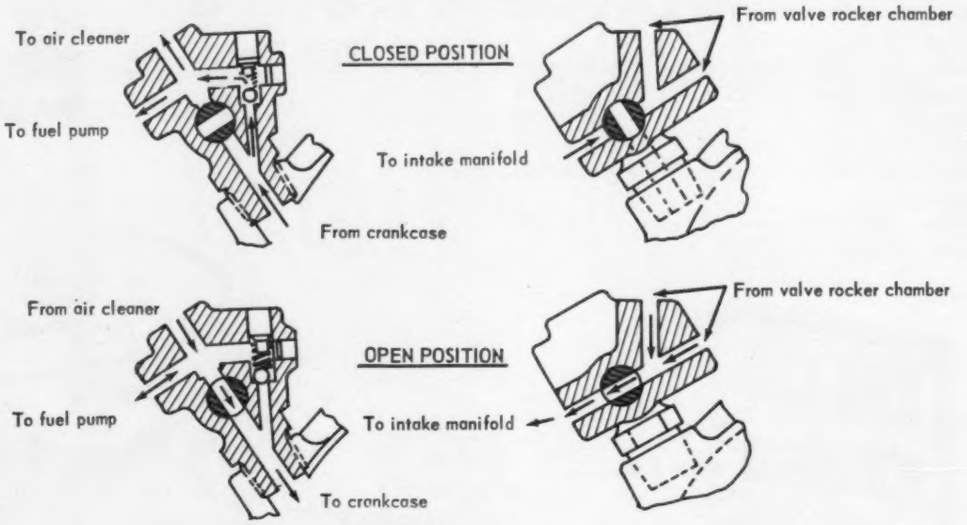
2 POINT
•
3 POINT

FLUSH CATCHES

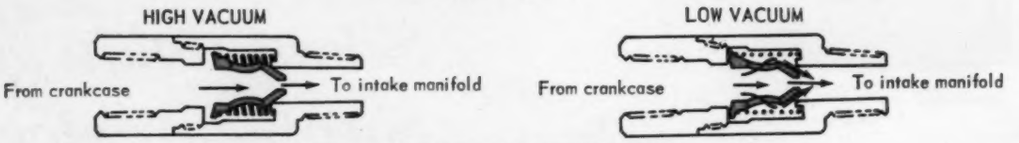
Circle 13 on Reader-Service Card for more information

Combustion Blow-By Pressurizes Engine Crankcase

Robert L. Candlish, Detroit Editor

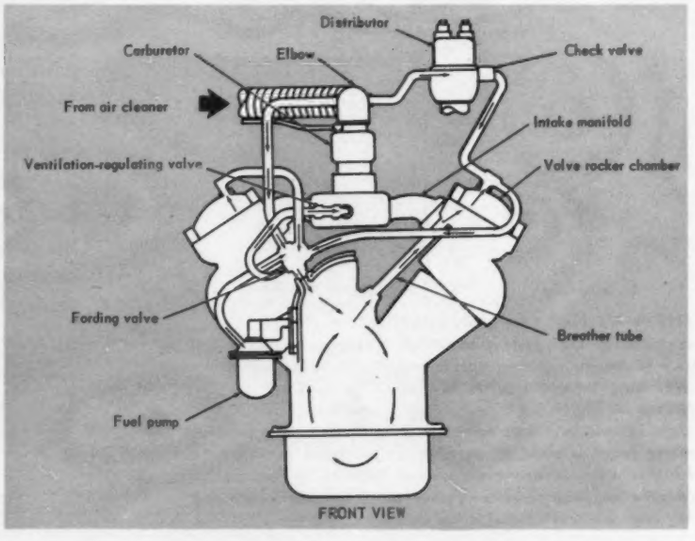


FORDING VALVE



VENTILATION REGULATING VALVE

ENGINE CRANKCASE is ventilated positively by means of a-c regulating valve controlling flow of blow-by gases and ventilating air to intake manifold. Ventilating air from clean side of carburetor air filter enters crankcase through fording valve, then flows up vent tubes to valve rocker chamber. Tubing then conducts gas once again through fording valve and then through a-c ventilation-regulating valve into intake manifold. Ventilation system also includes fuel pump and distributor. Four-cylinder, four-cycle, V-type air-cooled engine of aluminum construction, rated at 55 bhp at 3600 rpm is used in Marine Corps M-422 Mighty Mite ¼-ton 4 by 4 lightweight tactical truck. Engine components are completely waterproofed and when fitted with snorkel breathing system will operate completely submerged.

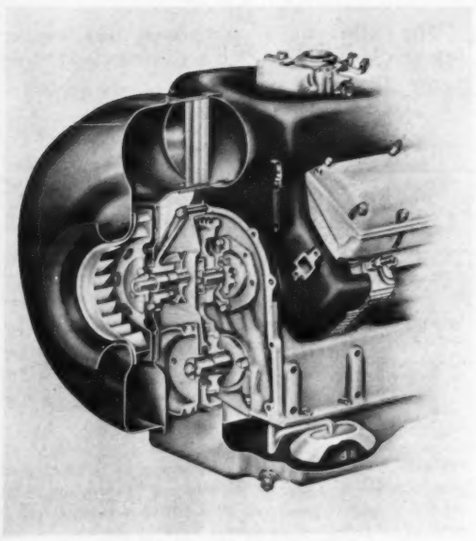


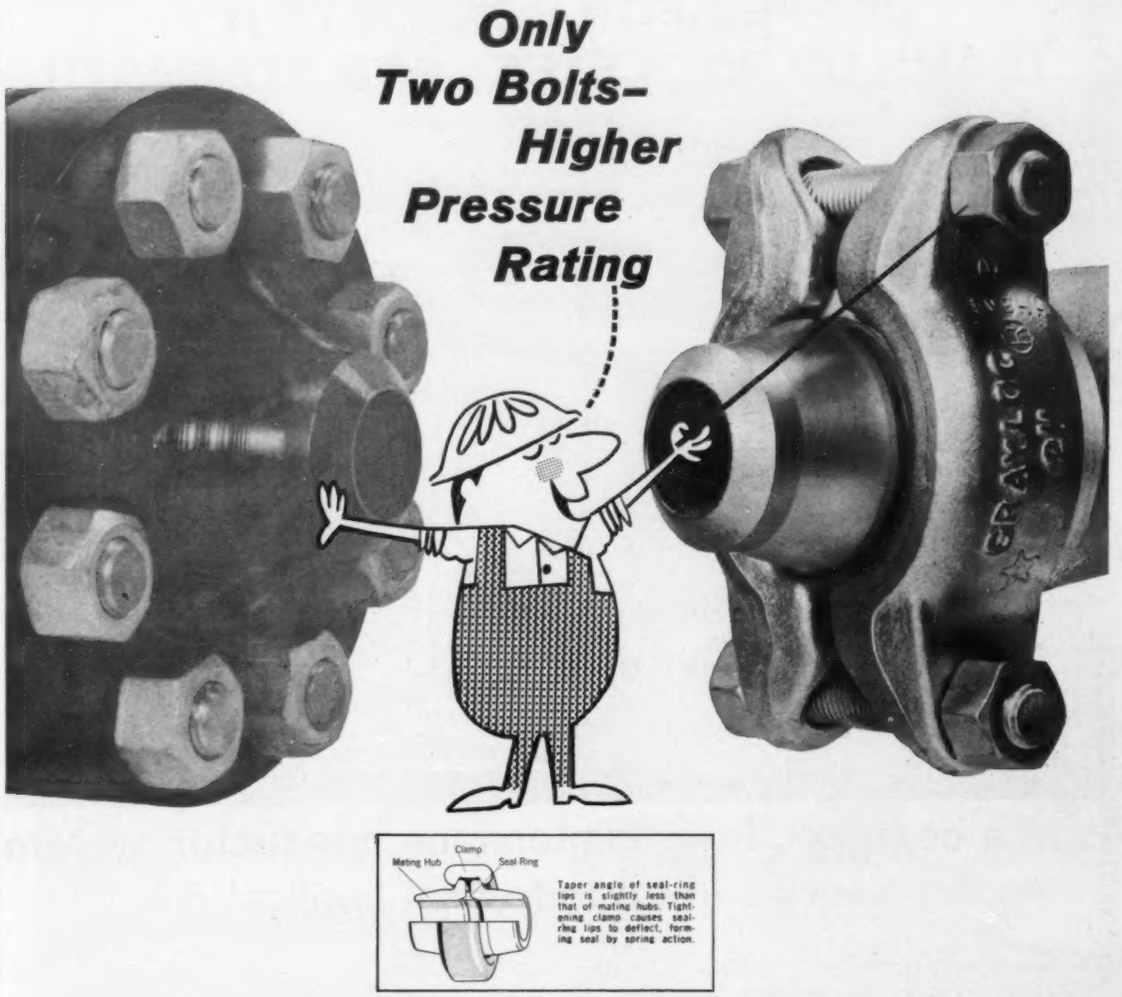
for Stream Fording

Combustion blow-by past piston rings of military vehicle engine is regulated automatically to pressurize the crankcase for leak protection during operation submerged in water. Specifications on the vehicle concerned (M-422 Lightweight Tactical Vehicle) require that it be able to ford a hard-bottomed stream 60 inches deep. To counter this pressure tending to force water into the engine, the crankcase ventilation system is sealed off by means of a fording valve, causing a positive pressure to build up in the system. A regulating valve is incorporated to maintain this pressure between 2.0 to 2.5 psi to adequately balance the external water pressure and to prevent any loss of power output from over-pressurizing the crankcase.

The crankcase pressure-regulating system is a development of American Motors Corp., Special Products Div., Detroit, Mich.

FORDING VALVE is essentially two-position, four-port type with spring-loaded ball pressure-regulating valve. In open position, flow of ventilating air and blow-by gases is unrestricted. In "fording" position, ventilating air and regular passage for crankcase gases are shut off. Flow of blow-by to carburetor intake is controlled by pressure-regulating valve.





Mating Hub
Clamp
Seal Ring
Taper angle of seal-ring lips is slightly less than that of mating hubs. Tightening clamp causes seal-ring lips to deflect, forming seal by spring action.

GRAYLOC® Pipe Connections can be assembled in less than 1/3 the time required for a comparable flanged assembly — yet GRAYLOC Connections provide as much as twice the maximum pressure rating.

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COPPER FOR CONDUCTIVITY TEAMS UP WITH STEEL FOR STRENGTH

...in a compact, low-maintenance conductor system for heavy-current industrial applications

The copper-headed steel conductor rails, shown above, of the Ringsdorff Carbon Corp., East McKeesport, Pa., help provide many economies in conductor systems for such heavy-current users as traveling cranes, ore bridges, monorails—using either a-c or d-c.

The heart of the Ringsdorff Current Conductor System—the copper-headed steel conductor rail and pantograph current collector with a graphite carbon shoe. Components, including rail hangers and joints, are available in a wide variety of sizes, with capacities up to 2000 amps, for either a-c or d-c systems.

The system is simple and compact. One basic steel shape provides strength and simplifies installation. Over it is cold drawn the copper head of extruded Anaconda ETP Copper-100, in the size to meet individual current requirements. (Copper-headed conductor rail, left, 500 amps; right, 1500 amps.) Less space is needed; installation is easier than with aluminum rails.

Long life and low maintenance. The special Ringsdorff carbon graphite used in sliding contacts has an affinity to copper, putting down a film that lubricates its passage and protects the rails. Wear on the copper head is negligible over periods of 20 to 25 years. Only maintenance is replacement of carbon shoes, having an average life up to 3 years. Aluminum rails must be protected by lubrication or they will wear and pit—when out of use for a period may develop an insulating oxide film.

This is another illustration of the way the unique properties of copper are being utilized in industry to do things better—at lower cost. Anaconda has teams of specialists available to sit down with members of your organization to help select the alloys and forms of metal to solve your value analysis problems. For such technical help, see your Anaconda representative, or write: Anaconda American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario. 6147

ANACONDA®

COPPER BRASS BRONZE NICKEL SILVER MILL PRODUCTS

Anaconda American Brass Company

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Large Clearance Volume

Lars G. Soderholm, Midwest Editor

A miniature oilless motor-powered compressor and vacuum pump uses an abnormally large clearance between the piston and cylinder head to eliminate the necessity for a safety valve. This arrangement also resulted in low power requirements and permited a smaller electric motor to be used.

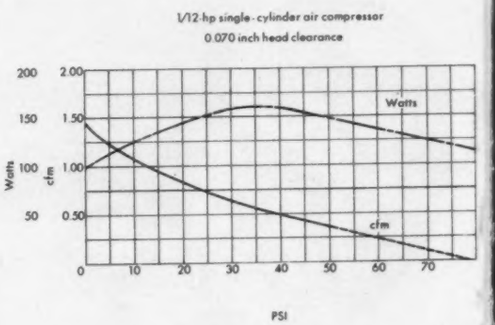
Initially designed to simplify the construction of the compressor, the large head space was left to prevent excessive pressures from building up in the cylinder head. Normal clearance would be about 0.008 inch. For this application, clearances up to 1/14 inch were used.

In addition to limiting the pressure inside the cylinder to about 70 psig, the unit having large clearances was also found to have much lower power requirements than were expected. A 1/12-hp split-phase, induction-type motor was capable of providing all the capacity necessary.

The single-stage, single-cylinder compressor and vacuum pump uses a 2-9/32-inch-dia aluminum piston having a 0.350-inch stroke. Operating at 1725 rpm results in an approximate 50 ft per minute piston speed. The oilless operation results from a carbon-graphite skirt around the piston and a carbon-graphite piston ring.

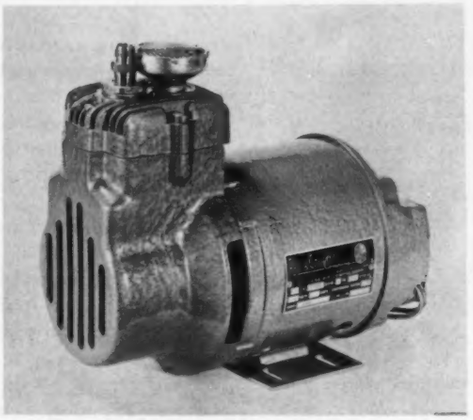
The miniature compressor is provided in 1.43-cfm displacements and the vacuum pump in 1.9-cfm displacements. Weight of the unit is 18 lb. All components are standard parts.

The oilless motor compressor and vacuum pump is made by the Bell & Gossett Co., Morton Grove, Ill.



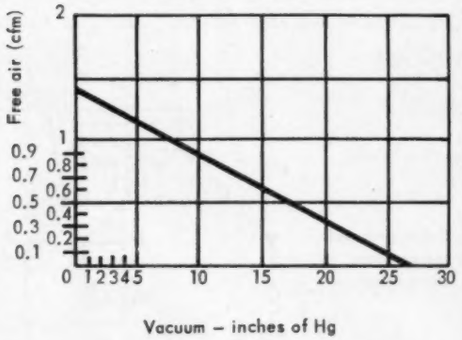
POWER REQUIREMENTS plotted against pressure show peak reached at about 35 psi followed by drop in power needed at higher pressures. It is felt that re-expansion is helping to reduce consumption over 35 psi.

Eliminates Safety Valve

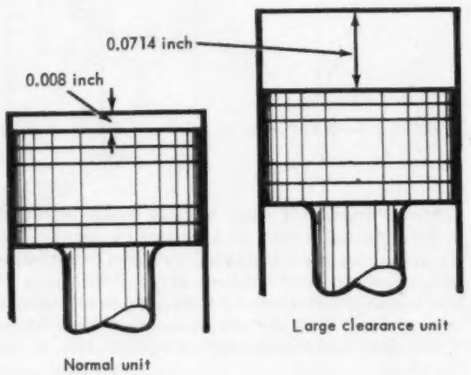


MODEL LV

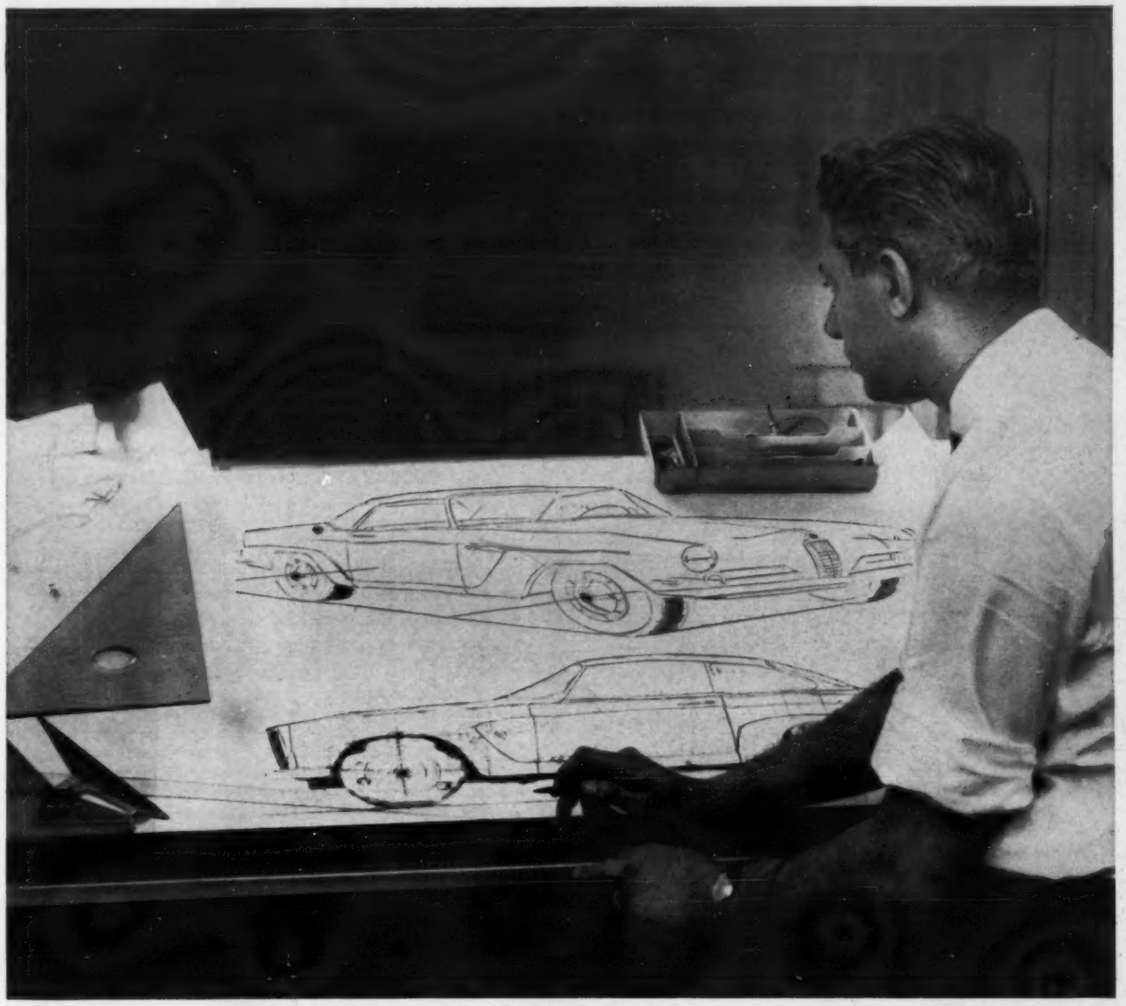
Vacuum pump performance



VACUUM-PUMP MODEL uses same components as compressor, and has same large head clearance.



WHAT'S NEWS IN RUBBER



In design after design...the big switch is to BUTYL!

Automotive engineers have discovered that Enjay Butyl rubber is one of the best ways to improve car performance. Now all U.S. cars contain parts made from Enjay Butyl . . . parts such as weatherstripping, body mounts, engine mounts, radiator hose, accelerator pedals, and many more. Engineers specify Enjay Butyl rubber because...

- *Butyl resists weathering*
- *Butyl deadens noise and vibration*
- *Butyl absorbs shock*
- *Butyl beats the heat*
- *Butyl resists tear, flex and abrasion*

Enjay is always ready to help manufacturers build the extra performance of Butyl into their cars. For more information, contact Enjay's Detroit Area Office, 17360 West Eight Mile Road, Southfield, Mich. Phone KEnwood 2-7113.

ENJAY® BUTYL

EXCITING NEW PRODUCTS THROUGH PETRO-CHEMISTRY

ENJAY CHEMICAL COMPANY

A DIVISION OF HUMBLE OIL & REFINING COMPANY

Circle 16 on Reader-Service Card for more information

Is your secretary better equipped than your engineers or draftsmen?

She deserves the best, bless her, and often gets it—but your skilled *draftsmen*, too, need today's tools to cope with today's demands.

Your draftsmen, your productivity, deserve new Hamilton space-and-time-saving equipment — from Bruning

Even your most efficient and productive men turn out better work with high-quality, professionally designed drafting equipment. They will accomplish more, make fewer errors and be far less fatigued when they work with Hamilton professional equipment. Basic Hamilton design gives your engineers or draftsmen new capacity for increased efficiency and improved morale. Our designers will help plan your individual needs.

HAMILTON DELUXE AUTO-SHIFT TABLE This unit combines modern styling with advanced features to create top efficiency. It greatly reduces fatigue, helps your men achieve the highest quality in draftsmanship and maximum production. Fully seasoned drawing surface is adjustable to individual height and slope requirements, providing complete board accessibility that reduces errors. Fast, simple adjustments. Unusually durable and handsome in appearance.

Hamilton Unit System Files
Provide full protection, accessibility, and classification for all materials to be filed. Occupy minimum floor space.

Hamilton L-Contour Table
Prestige-assured, individualized work area providing complete board adjustment plus extra storage and reference area.

Hamilton CL 100 Drafting Table
Conserves dollars, yet rugged canted-leg design provides modern styling and convenience with long-term durability.

Put draftsmen in a "position" to do better, faster work!

Bruning's all-new Neoglide drafters literally help draftsmen straighten up and do faster, better work.* They provide complete maneuverability on any board at any angle without adjustment! Reinforced U-beam construction assures rigidity, strength, and accuracy. Resistance-free movement of vertical beam and hidden counterweight provide fast "floating" action. Touch-control protractor head gives automatic, pinpoint angle selection.

*Study of 300 draftsmen showed 35% savings in drawing time—1/5 the backaches—on vertical or near vertical boards.

BRUNING

CHARLES BRUNING CO., INC.
1800 CENTRAL RD., MT. PROSPECT, ILLINOIS

Circle 17 on Reader-Service Card for more information

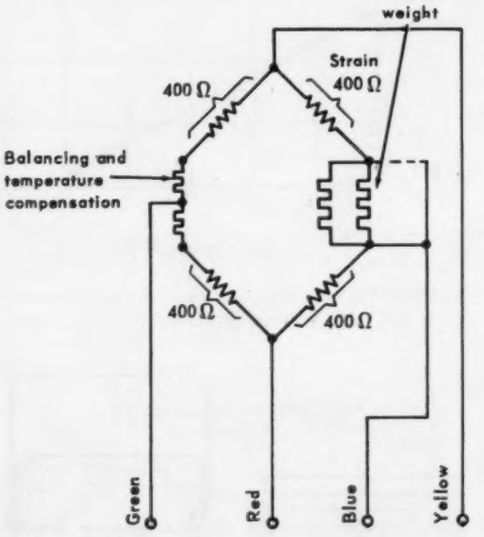
H-Section Increases

Volrath Holmboe, Correspondent in Sweden

By using an H-like section rather than a circular one, resistance against bending in a strain-gage load unit is increased several times. This feature is particularly valuable when weighing long stationary tanks where expansion or contraction resulting from temperature changes may set up lateral forces in the load unit.

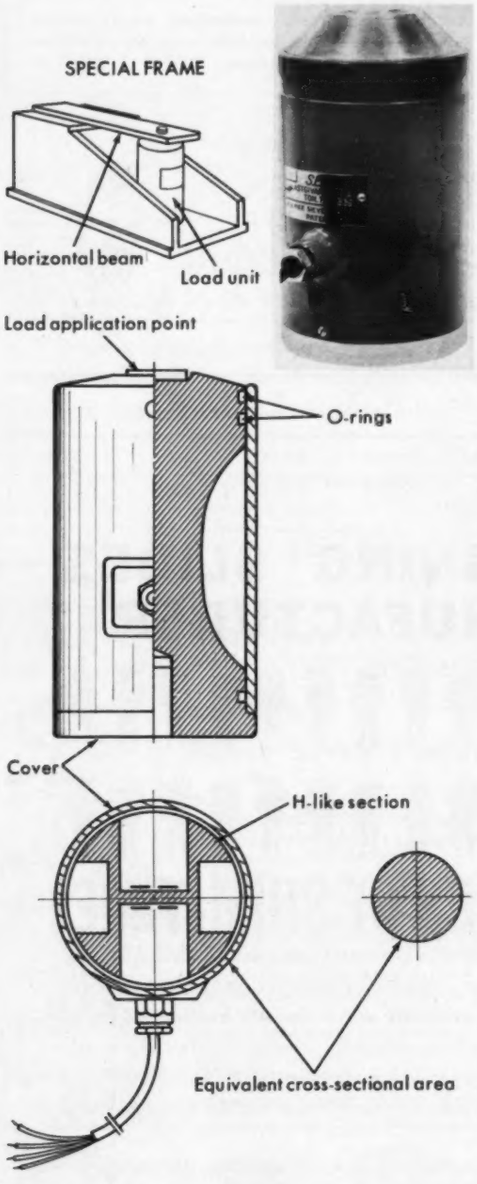
The H-like section is formed by milling four longitudinal grooves along part of a thick cylinder. Grooves are displaced 90 deg and reduce original cross-section by 75 percent. Two or four strain gages are located on each side of the web where the effect of bending is smallest. Any remaining effect is normally taken care of by the bridge connection of the gages. The thin web keeps gages close together to minimize temperature differences and related undesirables.

Available in different sizes with capacities ranging from 0.75 to 96 tons, the load unit was designed by AB Max Sievert, Stockholm, Sweden.



CIRCUIT DIAGRAM shows four-pole bridge connection of strain gages. Different colors are used for identification. Green line carries all calibration resistance for balancing and temperature compensation. Temperature compensation is obtained by using materials with thermal properties opposite to those of strain gages. Adjustable resistance in red line located in separate unit takes care of tare weight.

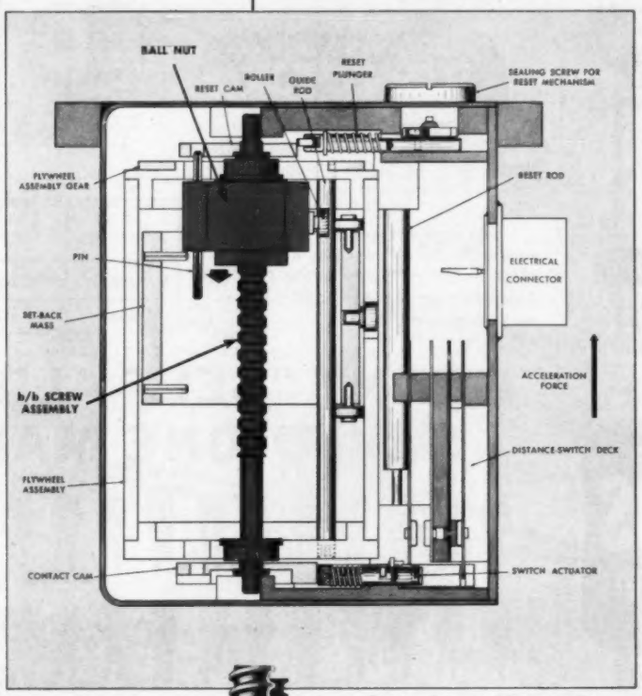
Bending Resistance



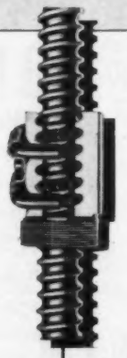
CYLINDRICAL ENDS of H-sectioned portion with heavily compressed O-rings keep load unit water-tight. Further resistance against corrosion is obtained by using chromium or cadmium-plated steel in all parts. Load application point consists of soft iron in order to permit some setting with time.

When the Bird's on the wing

SAGINAW b/b SCREW HELPS INTEGRATE TIME AND DISTANCE FROM 2 TO 50 G's



Courtesy Integrated Dynamics Div., Globe Industries, Inc.



Saginaw Steering Gear Division, General Motors Corporation, Saginaw, Michigan.

Saginaw ball bearing Screw

Circle 18 on Reader-Service Card for more information

Saginaw Ball Bearing Screws are highly efficient whether they are driving or being driven. A unique example is the way Integrated Dynamics Division, Globe Industries, Inc., Albuquerque, New Mexico, uses a b/b Screw.

First, the design problem: Develop a time-delay switching device which integrates the time function with missile's linear travel. The purpose is to safely arm the warhead. A strict "minimum G—time" system may arm a slow bird too soon for adequate protection of our own forces . . . and a fast missile may arrive before the warhead is fused.

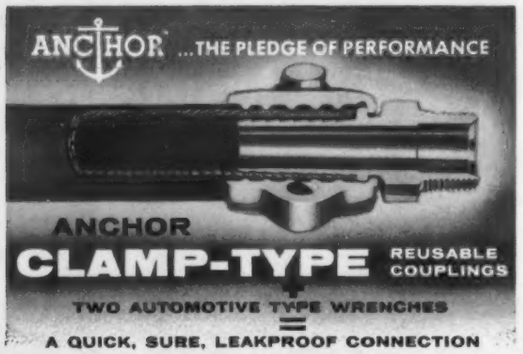
Integrated Dynamics developed and builds the mechanical distance switch shown in the functional drawing to the left. The high-efficiency Saginaw b/b Screw is used to convert linear acceleration force into torque. Essentially proportional to the G-force, the torque of the b/b Screw is used to drive the flywheel mass. Flywheel energy, in turn, is used to actuate the arming switch through a cam.

The time required by the ball nut of the Saginaw b/b Screw to travel the length of the screw is also almost directly proportional to applied G-force. Thus, missile travel in distance is effectively integrated into a time delay which arms the warhead within a ± 5% of the desired distance on accelerations between 2 and 50 G's.

The Saginaw b/b Screw runs dry — without lubricants — in this application. Using the same b/b Screw, the switch gives repeatable distance accuracy of one percent. The screw is ground and electropolished to a surface finish of less than 5 microinches. The balls used are only one millimeter in diameter.

Whatever your actuation problem, chances are you can use a Saginaw b/b Screw to do the job efficiently. Why not write Saginaw b/b Screw and Spline Operation, Saginaw Steering Gear Division, General Motors Corporation, Saginaw, Michigan.

WRITE FOR OUR NEW DATA BOOK OR SEE SWEETS DESIGN FILE



Engineers and operators rely on these easily applied, streamlined Anchor Clamp-Type Couplings for fast, emergency repair and field service, as well as original equipment application.

Designed to accommodate normal variations in hose, they can be applied in the field with no tools other than a pair of automotive-type wrenches, and once applied, provide a sure, safe, leakproof connection that will remain intact up to the burst point of 2 and 3-wire braid hose.

Anchor Clamp-Type Reusable Couplings are supplied in high, medium or low pressure styles, for 3-Wire, 2 Heavy Wire, 2-Wire, 1-Wire, and Hi-Burst 2-Rayon Braid Hose, as well as Spiral Wire Suction Hose.

Write for Catalog No. 303

Andy Anchor says: "The Anchor representative is a qualified specialist. Consult him on your hydraulic plumbing problems."

ANCHOR COUPLING CO. INC.

314 North Fourth St., Libertyville, Ill.
Branch Plants: Dallas, Texas; Plymouth, Mich.

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New Stock Molded Knobs

AVAILABLE WITH OR WITHOUT SKIRTS

4 Standard Sizes

Meet MIL-P-14 Specs

MODEL RB-1250-SK illustrated

Molded of thermosetting phenolic or urea materials. Available in 4 standard sizes with nickel plated brass inserts for ¼" or ⅛" diameter shafts. Aluminum decorative inserts or skirts, etched and filled as desired . . . various anodized finishes, plain or radially spun. Write for new catalog illustrating Rogan's complete line of stock molded knobs.

ROGAN BROTHERS, Inc.

8005 N. MONTICELLO • SKOKIE, ILL.

Specializing In Stock Molded Knobs Since 1939

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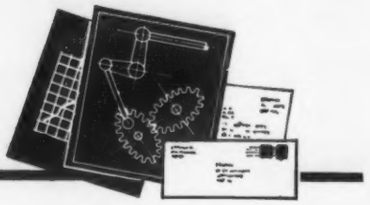
IDEA MART

DESIGN NEWS



AVAILABLE

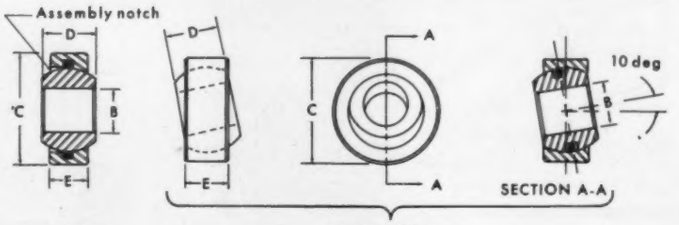
Universal Shaft Seal

Ideas described in this department are in various stages of development and may be at any point from "initial concept" to "patented".

Applications requiring a seal of this type might include a shaft mounted at an angle, accompanied by a wobble motion or misalignment. It is not recommended for fast speeds. The device may suggest movements that could not be used with other type seals.

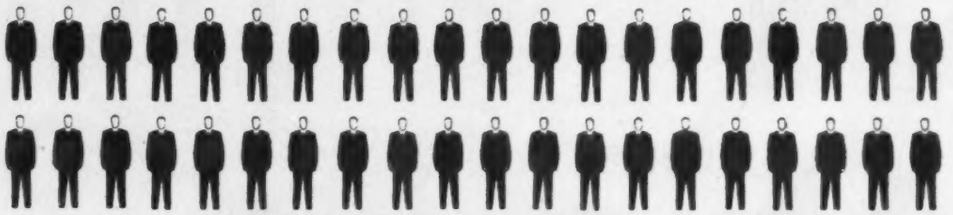
An O-ring is mounted in the outer ring to form a seal for the inner bearing race. Although another arrangement is shown, the USR model is preferred because it allows greater angular and wobble motion.

I have used this seal on the automatic drain valve for a commercial dishwasher. Wish to sell or license. Write IM 501, Idea Mart, DESIGN NEWS, 3375 S. Bannock, Englewood, Colo.

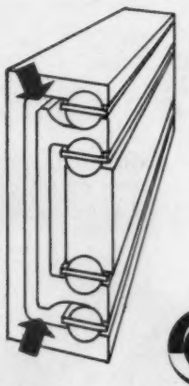


MODEL NO.	B BORE	C OUTSIDE DIA	D BALL WIDTH	RACE WIDTH	CHAMFER
UDS	0.3125	0.7500	0.375	0.276	0.020
USR	0.3125	0.9375	0.375	0.276	0.020

GRANT "SELF-ALIGNING" SLIDES SAVED ONE MANUFACTURER



40 MAN HOURS OF SHIM-TIME!



NOW, you can stop using shims. Time and labor saving Self-Aligning slides compensate for cabinet or chassis construction inaccuracies by an exclusive "built-in" design feature which results in slide action of the same efficient degree as within ordinary, wholly square chassis. All Grant Self-Aligning slides meet military specifications for material and finish. Load ratings on Grant Self-Aligning slides are the same as those for regular Grant slides.

Grant Self-Aligning slides are manufactured under U.S. Pat. No. 2,370,861.
We'll be pleased to send you additional data on request.

GRANT INDUSTRIAL SLIDES

Grant Pulley & Hardware Corporation

Eastern Division/19 High Street, West Nyack, N. Y.
Western Division/944 Long Beach Ave., Los Angeles 21, Calif.

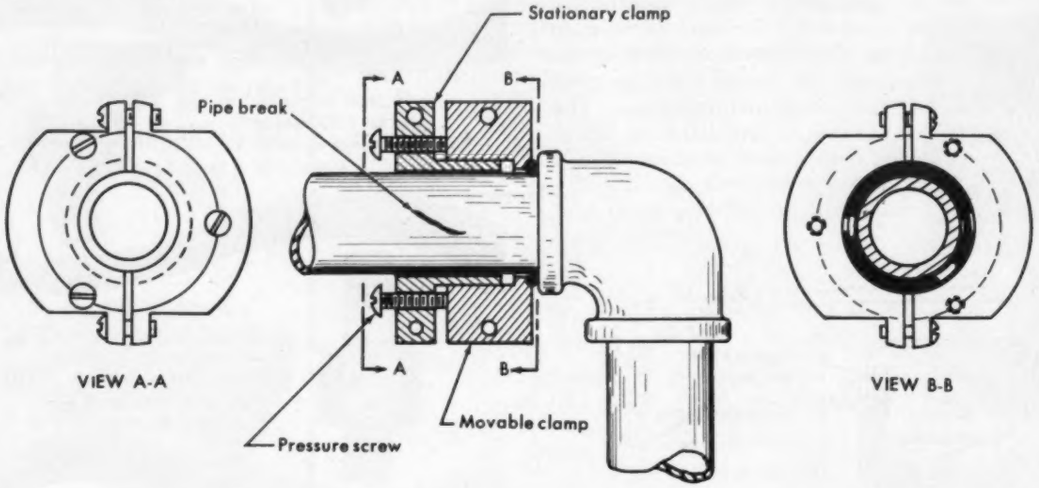
Circle 21 on Reader-Service Card for more information

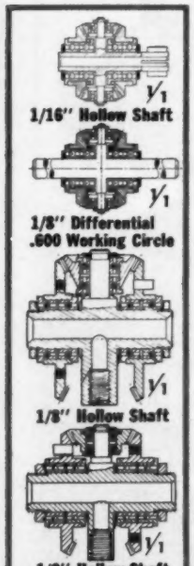
AVAILABLE

Quick Pipe Repair Seal

A two-part stationary clamp is placed over the break and securely tightened. The two halves of a movable clamp are then placed over the stationary clamp and partially tightened, allowing the movable clamp to slide. The movable clamp is pushed back against the stationary clamp and a gland inserted between the clamp and an elbow or coupling on the pipe. The clamp is then tightened and forced against the gland by hand. Pressure screws in the stationary clamp are then turned in to apply pressure to the movable clamp.

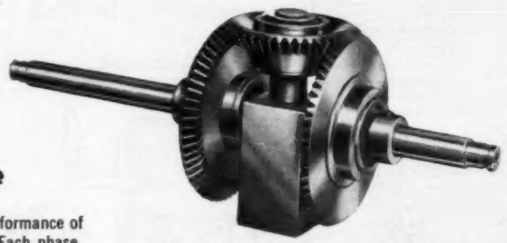
Both stationary and movable clamps may be made of plastic. Write IM 502, Idea Mart, DESIGN NEWS, 3375 S. Bannock, Englewood, Colo.





Dust-Free
PRECISION DIFFERENTIALS
by Arch
Boost Servo Performance

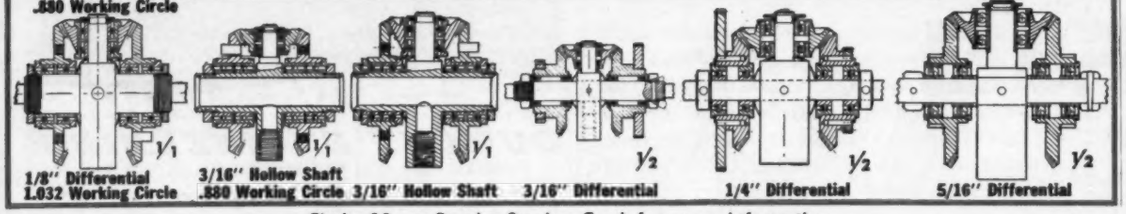
In today's highly sensitive servo systems, optimum performance of precision differentials depends upon many factors. Each phase, from design to manufacture and assembly, must be critically controlled with special emphasis on dust and temperature control. At Arch Instrument, all assembly, testing, calibration and packaging of precision differentials is performed in a new and specially built dust-free and temperature controlled "white room" to assure you tolerances and performance far beyond the ordinary. In addition, the Arch line - consisting of ten models from 1/16" to 5/16" - offers greater design flexibility with interchangeable end gears and modifications of backlash and breakaway torque to customer specifications. To learn more about Arch's ability with precision differentials, write or phone for further information.



DESIGN LAYOUT FOLDER
Available to engineers, designers and purchasing agents. Contains differential tracings for use as an underlay in design layout work.

Arch INSTRUMENT COMPANY, INC.
101 HOLMES STREET, NO. QUINCY 71, MASSACHUSETTS

SEE US AT THE 1961 DESIGN ENGINEERING SHOW — BOOTH 1011



Circle 22 on Reader-Service Card for more information

CIRCLE SEAL GAUGE PROTECTOR

SERIES 1100

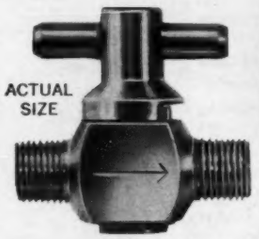
A safety shield for gauges and personnel, the Circle Seal Gauge Protector is designed for pneumatic or other gas systems as well as liquid service. Use of contact rather than sliding seals overcomes O-Ring breakaway friction problems associated with piston type units. Automatic cut-out when system pressure exceeds gauge limit... automatic cut-in when system pressure returns to normal maximum. In gas systems, surge or shock waves will close valve momentarily to reduce shock to gauge elements. Where gauges are cascaded, Gauge Protector automatically cuts out lower pressure gauges... cuts them in as system pressure falls.

PREVENTS COSTLY DAMAGE ... AUTOMATIC GAUGE CUT-OUT

From 15 to 2400 psi... —100° to 500°F. Wide range of cut-out pressure settings. Available in brass or 303 stainless.

Military Service:
JAMES, POND & CLARK, INC.
Industrial Service:
CIRCLE SEAL PRODUCTS CO., INC.
2181 East Foothill Blvd., Pasadena, Calif.

CIRCLE ® SEAL *precision valves*



CIRCLE SEAL MINIATURE PLUG VALVE

SERIES 9500

Miniaturized at no sacrifice in quality, the Circle Seal 9500 Series is ideal for application in instrumentation, inert gas test stands, hydraulic clamps, jacks, etc. The convenient "T" handle with 90° actuation provides effortless opening and closing. The handle is color coded for various gases and liquid service requirements. The visual indication provided by the "T" handle can be used as a metering device by turning the handle various degrees from full-on to full-off. "O"-Ring seals virtually eliminate wear. When required, simple repair is effected by replacing three "O"-Rings without removing valve from the line.

ABSOLUTELY LEAKPROOF ... EFFORTLESS CONTROL

Positive sealing from high vacuum to 2000 psi. Male or female connections in ⅛" or ¼" sizes. Brass or 303 stainless.

Military Service:
JAMES, POND & CLARK, INC.
Industrial Service:
CIRCLE SEAL PRODUCTS CO., INC.
2181 East Foothill Blvd., Pasadena, Calif.

CIRCLE ® SEAL *precision valves*

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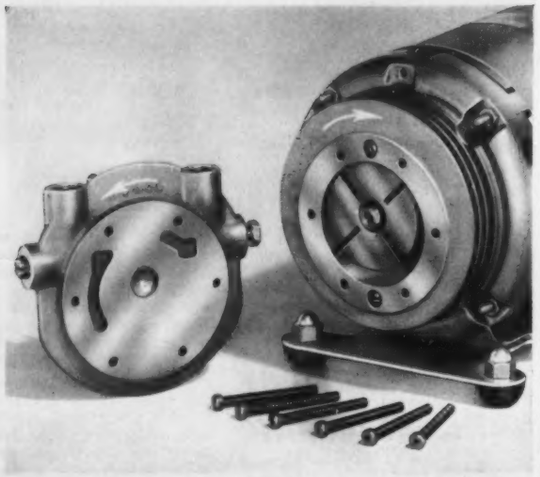


NEED AN OIL-FREE AIR SUPPLY?

Select from 3 types, 10 sizes

GAST OIL-LESS* AIR PUMPS

You gain five advantages when you specify Gast Oil-less Air Compressors or Vacuum Pumps.

1. Absolutely oil-free air delivery. No hot oil mist or odor can contaminate air flow.
2. No lubrication required. This eliminates problems for both manufacturer and user.
3. Lubrication costs for both time and lubricants are eliminated.
4. You have greater freedom in locating the pump, as easy access for oiling isn't a factor.
5. Oil-less design adds a sales feature to your product!

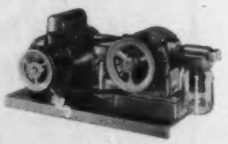
How is this possible? Rotary design has carbon vanes that lubricate themselves. Ball bearings are grease-sealed for life and located outside the pumping chamber. Simple construction assures long, trouble-free dependability.

Ten sizes; capacities from .35 up to 24 c.f.m. running open. For medium duty to 10 p.s.i.g. pressure or 20" Hg vacuum. For use on instruments, medical and laboratory equipment, food packaging and paper-handling machines, Gast Oil-less Air Pumps have much to offer.

Miniature models, .35 to 1 c.f.m.

Direct coupling drive, to 5.9 c.f.m.

Integral-motor types to 1.1 c.f.m.



V-belt drives, up to 24 c.f.m.

*A wide range of lubricated models also available.

WRITE TODAY FOR OIL-LESS BULLETINS — if possible, specify c.f.m. range that interests you.

Air Motors • Vacuum Pumps • Compressors

GAST MANUFACTURING CORP.

P.O. BOX 117-G, BENTON HARBOR, MICHIGAN

Circle 24 on Reader-Service Card for more information

Damping System

French Patent 1,243,004; Albert Lenoir, assigned to Societe Nationale des Chemins de Fer Francais, Paris, France.

This damping system is designed for railway cars, but can be adapted to other situations. The bogie frame is connected by means of the main springs with the crossbeam which carries the car frame. This beam also carries a friction plate capable of small horizontal movement. This plate, which bears on a vertical friction surface carried by the bogie frame, is connected to a fixed point on the frame by a second spring. When the main spring is deflected under load,

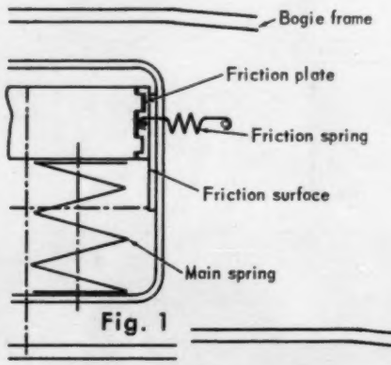


Fig. 1

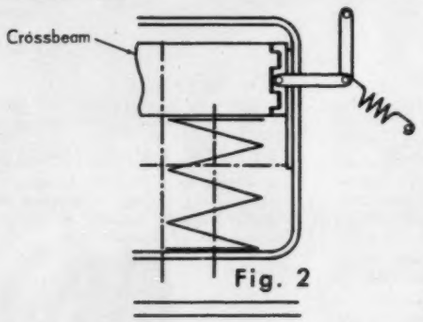


Fig. 2

the friction spring's length is increased by the geometry of the system and the friction force increases to provide a progressively increasing damping force.

An alternate arrangement of the connection of the friction plate with the bogie frame is shown in Fig. 2. The rod arrangement increases the force which applies the friction plate because the friction spring's tension must now be counterbalanced by two rod tensions almost perpendicular to the spring axis.

DUMONT self-aligning swivel fittings automatically compensate for any misalignment up to 14°.

Every DUMONT self-aligning swivel has a 360° rotation with a comparatively low torque rating.

DUMONT self-aligning units are available with several different configurations (any angle) and fitting ends to assure their flexibility and usefulness.

DUMONT'S pressure balanced plane swivel, with its 360° rotation, develops less resistance to rotation, than any other known rotary connection.

ADAPTABILITY

IN FLUID ROTARY CONNECTIONS*

Whether combined to form a complex or used individually, these rotary connections, produced by DUMONT ENGINEERING, offer the utmost in adaptability.

These units offer an excellent solution for many oscillating or rotating fluid line problems and have such a universal application that they are suitable for nearly all types of liquids and gases. They are also suitable for operation pressures up to 5,000 PSI. To insure its function and reliability, every unit undergoes rigid inspections for quality control.

Many special swivel designs, sizes and fitting ends are available. Our engineering consultants are well qualified to assist you in the selection, design and/or development of a unit to fit your specific needs.

* PATENTS APPLIED FOR

For complete information and specifications write or phone:

DUMONT ENGINEERING

DEPARTMENT D 1, 1401 FREEMAN, LONG BEACH, CALIFORNIA

PHONE: SPruce 5-1131 • GEneva 3-4931

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SEALMASTER

"L" SERIES

A HIGH QUALITY LINE OF MALLEABLE HOUSED BEARING UNITS AND BEARINGS AT A COST THAT IS WARRANTED ON YOUR MACHINE!

ECONOMY PERFORMANCE QUALITY

LF 3-BOLT FLANGE UNIT

Available in pillow blocks and two or three bolt flange units for flush or recessed mounting. All units in the "L" Series available with the new SEALMASTER contact type seal.

LP PILLOW BLOCK

LF FLANGE UNIT

LFT FLANGE UNIT

WRITE FOR BULLETIN 359

SEALMASTER®

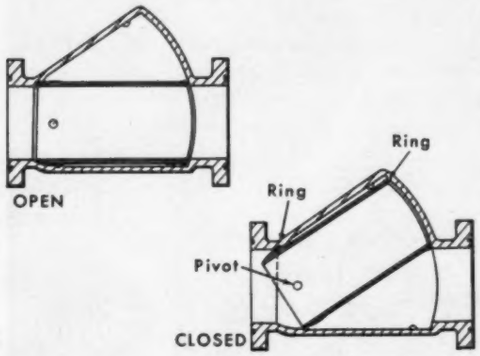
SEALMASTER BEARINGS
A DIVISION OF
STEPHENS-ADAMSON MFG. CO.
29 RIDGEWAY • AURORA, ILL.
PLANTS LOCATED IN: LOS ANGELES, CALIF. CLARKSDALE, MISS. • BELLEVILLE, ONTARIO

Circle 26 on Reader-Service Card

Valve

French Patent 1,243,230; Roger Delecourt, Chantilly, France.

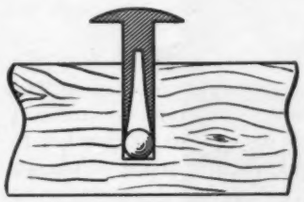
This very simple valve design allows unobstructed fluid flow in the open position. A tube is provided at one end with a spherical portion and at the other end with a cylindrical portion. The tube pivots inside the valve body on a point near the spherical end. A plate is used to close the valve housing. Rings are provided on both cylindrical and spherical portions of the casing and tube to control leakage.

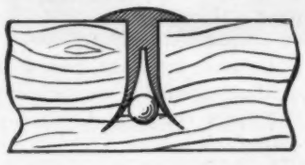


Fastener for Soft Materials

French Patent 1,243,448; Societe Gobin-Daude, Paris, France.

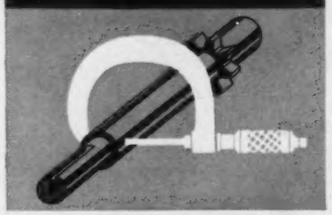
A steel ball placed in a blind hole in a soft or medium-hard material such as wood, and a nail with an internally tapered hole form this efficient fastening system. The ball, which is approximately the same diameter as the hole, sinks into the material. This displacement is accounted for by the length of the nail. The ball forces the end of the nail to expand in the hole and create a strong bond.



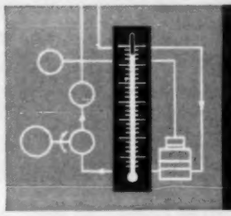


BERRY/DOWTY*
gear pumps

One million cycles without measurable wear



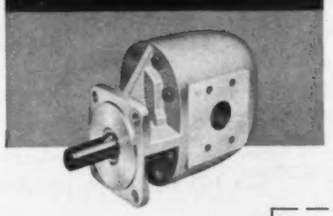
The Berry/Dowty line of hydraulic gear pumps has been subjected to exhaustive endurance tests. A Model GPA3/170 (rated output 24.5 GPM at 1800 RPM and 2000 PSI) was put through a one million cycle 0-2000 PSI test, with the final 200,000 cycles at 230° F. There was no measurable wear as a result of this test. In this and other tests, volumetric and mechanical efficiency has increased slightly from beginning to end of test, a result of the self-compensating design.



Performance guaranteed at 230°

Performance and warranty are unaffected by system temperatures of 230° F. provided minimum operating oil viscosity is 50 SSU. Volumetric efficiencies of 95% at 2000 PSI are normal under these conditions.

Pressures to 3,000 PSI
Outputs from 1 to 85 GPM
Speeds to 6,000 RPM



Value analysis (price, performance and reliability) proves the economy of Berry/Dowty Hydraulic Gear Pumps. Wire or phone today (Corinth, Miss., ATlantic 6-5541, Dept. K) for test units for evaluation on your equipment.

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Company
Address

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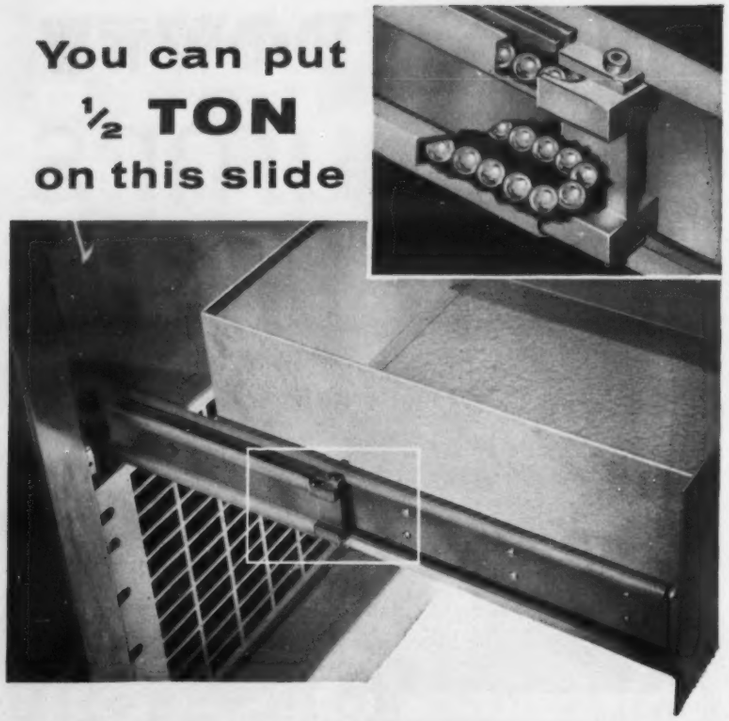
You can put ½ TON on this slide



New Heavy-Duty Slide from Chassis-Trak

Now you can rack-mount your heaviest electronic gear, yet keep it readily accessible for checking and servicing. A new heavy-duty Circulating Ball Slide, developed by Chassis-Trak, will easily support equipment in the 1000 lb. range, *even under extreme shock and vibration conditions.* Secret of the slide's strength is its Circulating Ball design *(see phantom view above).* Weight is distributed evenly over the balls which rotate in the direction of the pull, resulting in easy sliding action.

The new Circulating Ball Slide is permanently dry-lubricated with Poxylube 75, a bonded molybdenum disulfide film which assures smooth operation for the life of the slide. Easily assembled with standard hardware, the slide is available in lengths from 16" to 24" in two-inch increments and in lengths up to 60" in six-inch increments. Each track is only 1⅛" wide and 3" high, requiring much less chassis space than other slides in this heavy-duty range.

Get full details on the new CB Slide today.

for further information contact:

525 South Webster Ave., Indianapolis, Indiana

chassis Trak inc.

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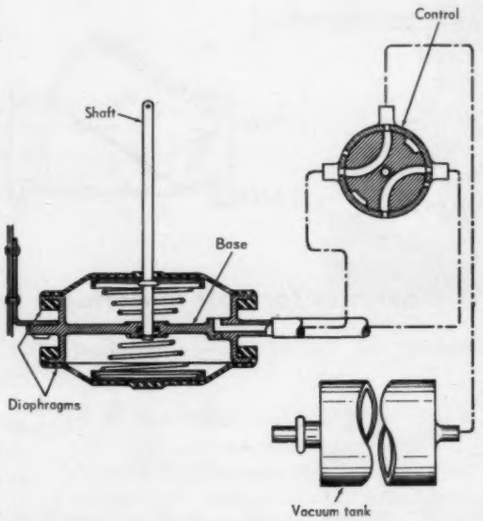
PATENTS

Fluid Motor

U. S. Patent 2,969,776; William C. Riester, assignor to Trico Products Corp., Buffalo, N. Y.

This vacuum-operated motor consists of a circular base with integral opposed cylindrical side walls. The base, which may be cast of metal or rigid plastic, thus forms two opposed dished surfaces with flanges. The base is provided with a central hole through which a shaft extends. An O-ring forms the seal.

Flexible diaphragms placed over each side form two chambers. The diaphragms are formed with beads to mate with the base flanges. Springs



are inserted in each chamber, with the lower end of each spring positioned on a projection and the upper end of each spring bearing against a dished washer. The shaft extends through one of the diaphragms.

To move the shaft downward, a control valve is positioned as shown in the illustration. This permits communication of vacuum between tank and upper chamber. Evacuation of chamber results in downward movement of the diaphragm against the spring force and in downward movement of the shaft. The lower chamber is vented at the same time.

To move the shaft upward, the valve is turned so that vacuum is communicated between tank and lower chamber. Upward movement of the diaphragm results.

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The following list compiled from recent issues of the Patent Gazette gives you increased coverage of new patents whose details may be useful to product and machine designers. Copies may be obtained from the U. S. Commissioner of Patents, Washington, D. C. The price is 25c each.

SELECTIVE DUAL POWER TAKE-OFF
U S Patent 2,975,643; Henry A. Ferguson, assignor to Deere & Co., Moline, Ill.

GEARLESS TRANSMISSION
U S Patent 2,975,645; Devereaux A. Durrett III, Montgomery, Ala.

BALL SCREW ASSEMBLY WITH INTERNAL BALL RETURN
U S Patent 2,975,649; Verle V. Propst, assignor to Beaver Precision Products, Inc., Clawson, Mich.

VARIABLE CAM-DRIVEN PUMP
U S Patent 2,975,719; Samuel Kaufman, Jacksonville, Fla.

SERVO ACTUATOR
U S Patent 2,975,767; William H. Liggett and James B. Gudikunst, assignors to Hughes Aircraft Co., Culver City, Calif.

COMBINATION PIPE COUPLING AND AUTOMATIC DRAIN VALVE
U S Patent 2,975,799; Robert E. Stilwell, assignor to Food Machinery & Chemical Corp., San Jose, Calif.

AUTOMATIC CLUTCH DEVICE
U S Patent 2,975,875; Johann Edelblut, Frankfurt am Main, Germany.

FUEL METERING AND PUMPING DEVICE
U S Patent 2,975,941; Alton G. DeClaire, Jr., assignor to Holley Carburetor Co., Van Dyke, Mich.

THERMOSTATIC CONTROL DEVICES
U S Patent 2,975,974; Wilbur F. Jackson and John W. Wright, assignors to Robertshaw-Fulton Controls Co., Richmond, Va.

COUPLING ADAPTER
U S Patent 2,976,063; Walter F. Kuhlman, Norwalk, Ohio.

COMPRESSION-TYPE HIGH-TEMPERATURE SEAL
U S Patent 2,976,066; Arthur J. Antoniades and Edward J. Bigelow, assignors to North American Aviation, Inc.

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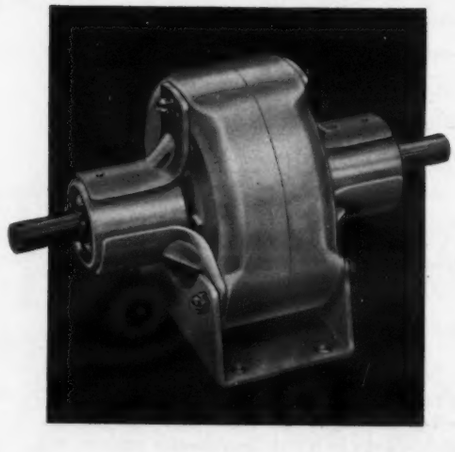
The Vickers Magneclutch® sets new performance standards for delicate torque control



Hair's-breadth accuracy of tension control often determines manufacturing success or failure. As gossamer yarns and ultra-thin paper and foil spin about on high-speed winding reels or bobbins, variations in tension can easily result in breakage, snarling, out of registry, costly down-time.

The Vickers Magneclutch meets this need with precise, delicate tension control—yet possesses a ruggedness that keeps it on the job under the most demanding conditions. Pinpoint control is maintained through the entire torque transmission range, from zero to full speed. Starts and stops, acceleration and deceleration are smooth, without grab or chatter. Available from 11 oz.-in. to 600 lb.-ft.

For complete story, contact the Vickers field engineer in your area, or write for Bulletin Series 6000. EPA 6000-8

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FULL SIZE

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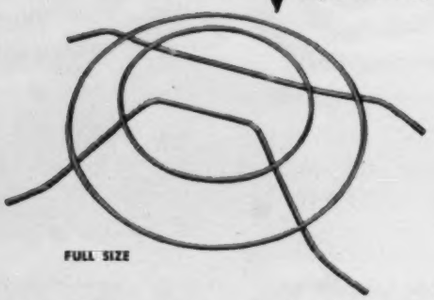

FULL SIZE

Our facilities for automatically forming wire components and welding wire assemblies can solve problems, save money. All sizes of wire from ⅜" to .047"— many metals, finishes, too. Engineering consultation is available for the asking.

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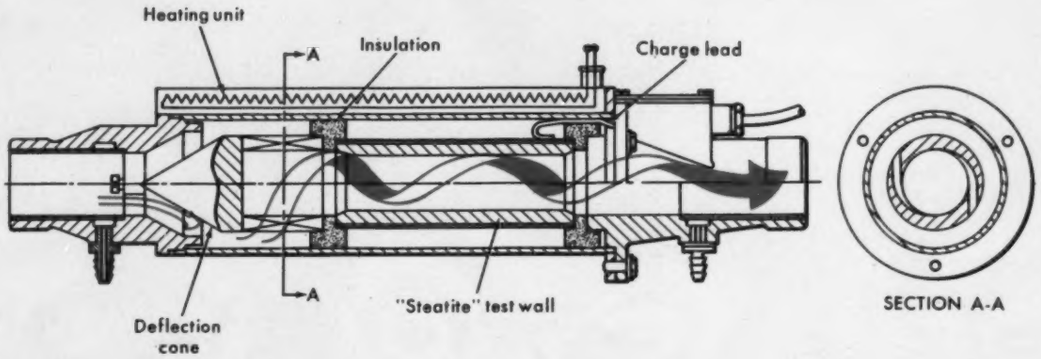
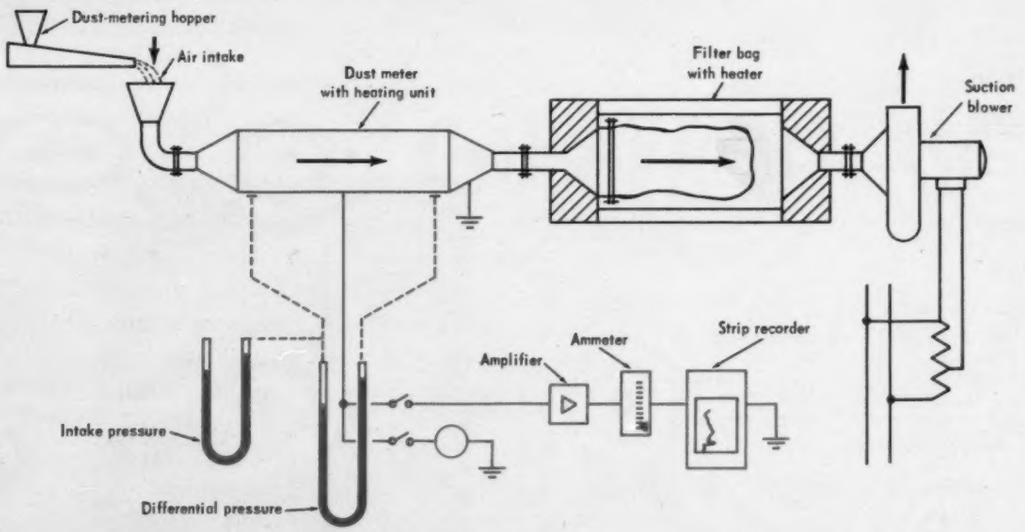
Electrostatic Charge in Gas Vortex Measures Dust Content

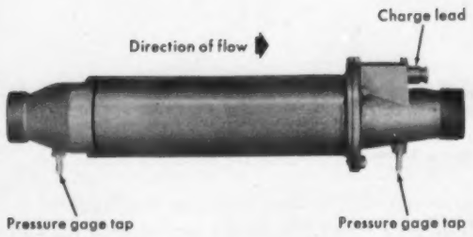
R. F. Stengel, German Editor



CROSS-SECTION shows in-line flow connections with bores leading to annular chamber. Pressure taps for manometer permit direct reading of flow rate after calibration. Gas flows past deflection cone into ring chamber, from which helical whirl passages lead into cylindrical vortex test section. As dust-loaded gas flows past insulation-mounted, white "Steatite" test wall, dust particles are forced into close contact with wall. Charge induced in wall flows off through charge lead to galvanometer. Heating unit prevents condensation in gases with high dew point.



CALIBRATING SETUP feeds dust of known composition and grain size. Blower pulls gas-dust mixture through meter. Filter bag with heater to prevent condensation retrieves dust, protects blower. Flow rate is measured by pair of manometers showing inlet pressure and pressure drop across device, which acts analogous to orifice. Induced electrostatic charge actuates galvanometer, is amplified, displayed on a meter and recorded on strip recorder. For continuous operation, dust hopper is replaced by sampling tube. After calibration, inlet pressure need not be measured. Remaining manometer measures differential pressure, yields flow rate. Strip recorder permits continuous monitoring. To avoid partial dust segregation and biased data, sampling tube enters vertical straight duct section well downstream of elbows.

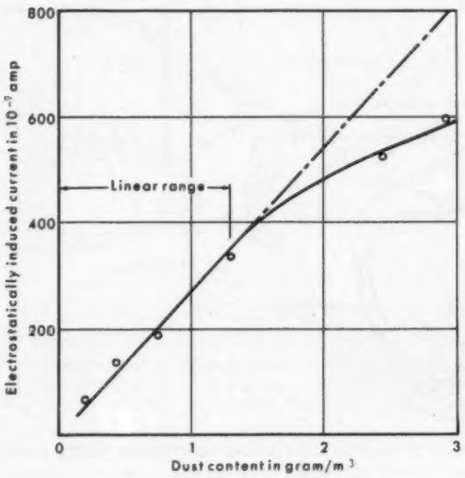


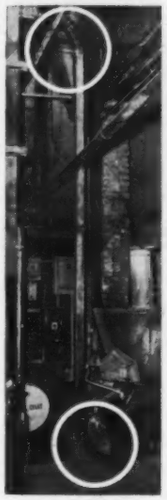
HOUSING has standard pipe threads; it is clamp-supported and separates at flange for maintenance.

As dust-loaded gas whirls in vortex motion through a meter, friction between dust particles and the "Steatite"-lined wall generates an electrostatic charge in the wall. A charge of opposite sign appears on the dust particles. Polarity and magnitude of the charge depend on grain size, specific weight and composition of dust, and on composition of wall lining. Charge magnitude is linearly proportional to rate at which dust flows through the test section.

Meter action is based on an effect discovered by Drs. Feifel and Prochazka, Vienna. Charge is generated only when dust particles flow in close contact with wall. Helical flow results in high number of turns per unit duct length and yields short but effective test unit.

The meter is used for monitoring air pollution and for process control where material is transported as entrained dust in a gas stream. "Konitest" dust meter is produced by J. C. Eckardt AG, Stuttgart-Bad Cannstatt, Germany.





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For example, industrial wheels made of ADIPRENE are outlasting those made of ordinary rubber 5 to 1. A leading auto manufacturer is using ADIPRENE for longer lasting ball joint seals. Manufacturers in both civilian and defense industries use ADIPRENE for impact, shock and abrasion resistant mounts, bumpers, bushings, suspension straps. A metalworking company is employing ADIPRENE as a female stamping die . . . finds that it survives 50,000 impacts as compared to only 400 for ordinary rubber. From "potting" to pulleys . . . from shoe heels to shock resistant grinding wheels . . . ADIPRENE's unique set of properties can help you design better, longer lasting new products. For more information about ADIPRENE write E. I. du Pont de Nemours & Co. (Inc.), Elastomer Chemicals Dept. DN-4, Wilmington 98, Delaware.

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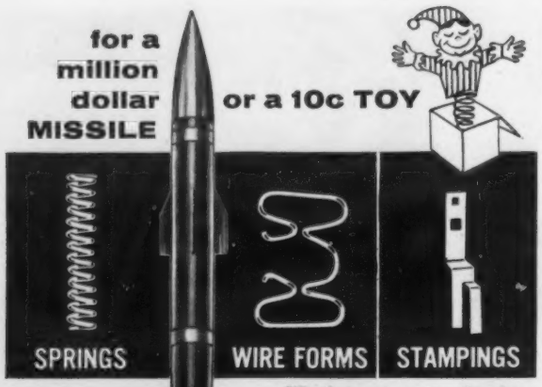

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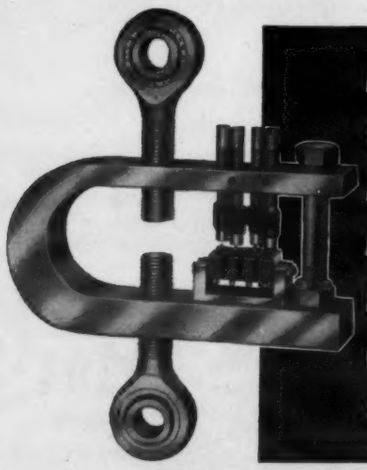

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Wire-In-Tube Mechanism Transmits Motion

E. J. Stefanides, Central States Editor

A new instrument mechanism uses only two moving parts to convert linear motion to rotary motion and transmit the rotary motion through a sealed wall.

The two parts are a curved beryllium-copper tube called the deflector and a similarly curved and hardened stainless-steel wire called the responder.

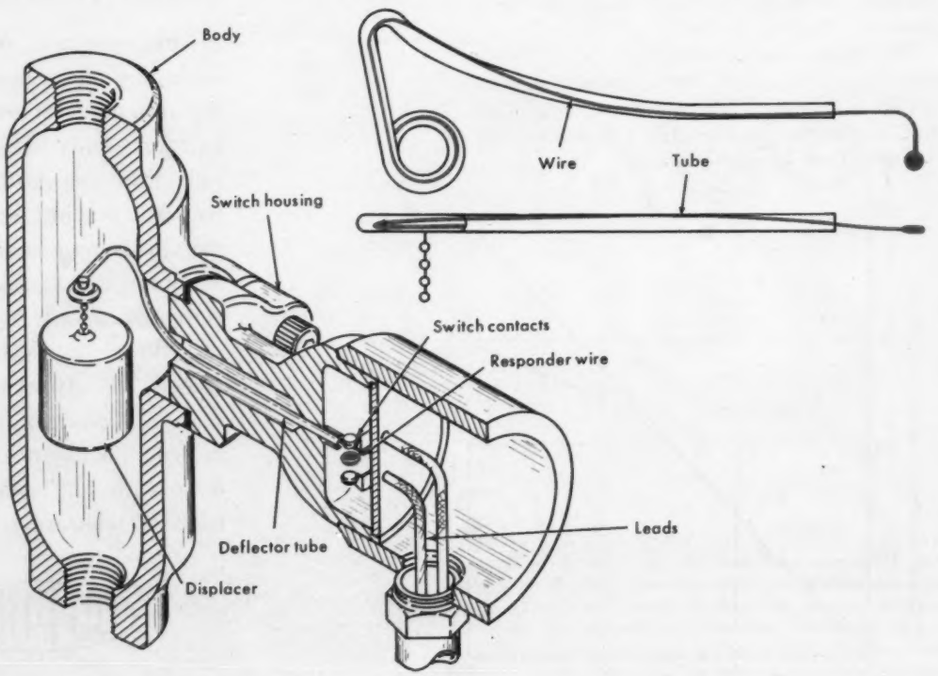
The free or sensing end of the deflector tube is sealed; the opposite end is open and passes through the pressure wall to which it is silver-soldered.

The responder wire is inserted in the deflector tube and then rotated so that the curvature of the wire is 180 deg out-of-phase with the curvature of the tube. This prestresses the wire, so that when the free end of the deflector tube is deflected (upward), at right angles to the plane of its curvature, the opposite end of the responder wire rotates with a snap action in one direction. If the end of the tube is deflected in the opposite direction (downward), the wire rotates with a snap action in the opposite direction. As a result, the device can be used to pilot either high-alarm (limit) or low-alarm (demand) functions.

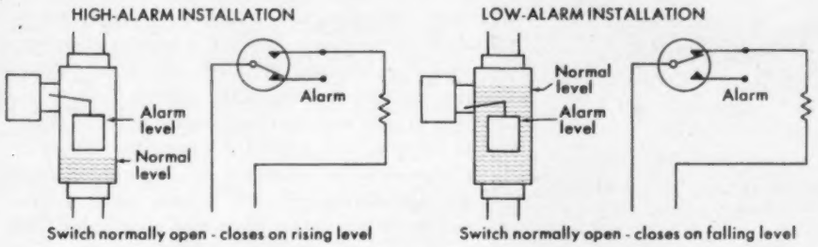
The mechanism also has a third use. With the curvature of the responder wire in phase with the tube curvature, deflection of the tube produces smooth rotation which is proportional to the degree of deflection. Thus, it can be equipped with a lightweight pointer and used as a scaling indicator, producing large arcs of rotation for slight tube deflection—in effect, a mechanical amplifier.

A positive pressure-sealing device, it combines simplicity with versatility and is adaptable to a variety of sensing applications. It can be used with any type of pickup which provides a linear or near-linear deflector displacement.

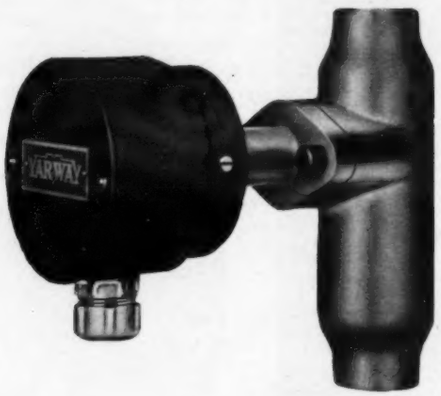
This mechanism was designed for a liquid-level switch by the Yarnall-Waring Co., Philadelphia, Pa.

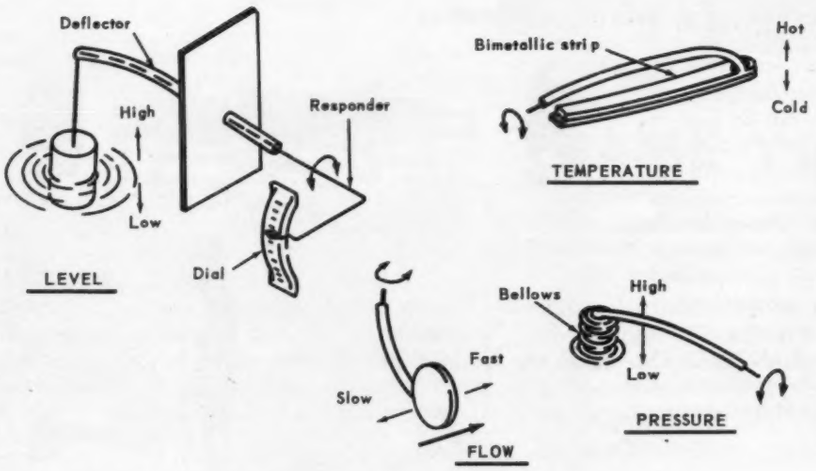


through Pressure-Tight Wall

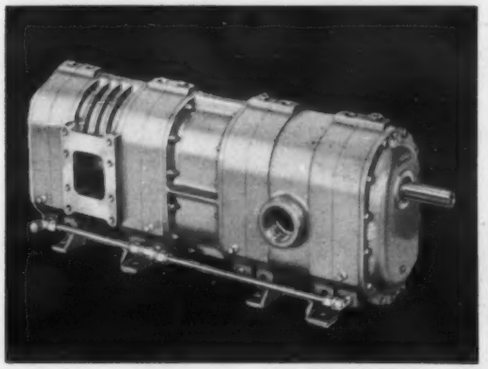


HIGH- AND LOW-ALARM INSTALLATIONS OF ON-OFF RESPONSE UNIT.





MODULATED RESPONSE FOR INDICATION is provided by assembling responder wire with its curvature in phase with that of deflector tube.



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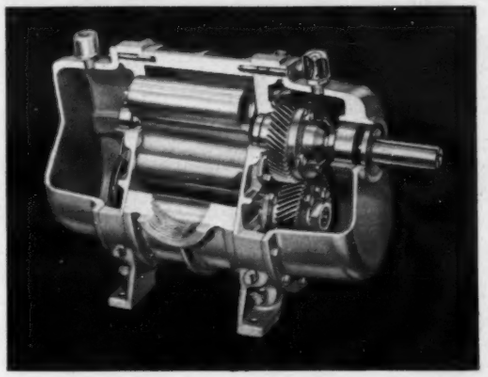

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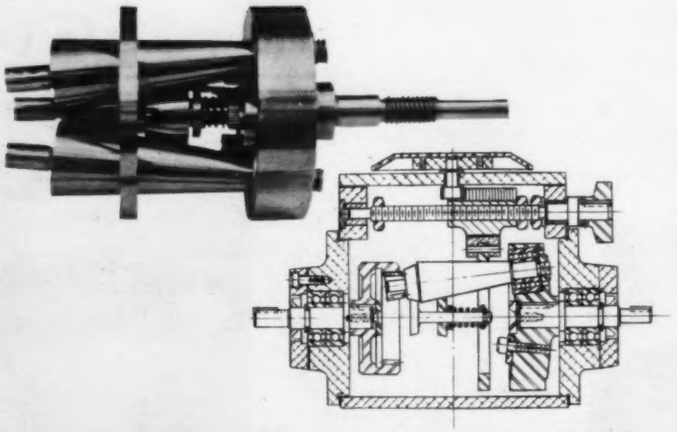
Corrects Output to ±10 Percent



An accurate variable-speed transmission is useful in instrument and control applications or light-powered equipment up to ⅛ hp. The unit is offered in three types: one that delivers all speeds from any desired maximum to zero, another that delivers speeds from maximum to zero and into full reverse without change of input rotation and a third designed for "speed correction" that may be connected to give output speeds that vary approximately ±10 percent from a given input speed. Entire drive, including a precision lead-screw control, can be enclosed in a housing approximately 2 by 2½ by 3¾ inches. The ultraprecision unit is a compound planetary system with nonrotating member, a traction ring, that engages tapered rollers at varying diameters. Input shaft supports carrier for tapered rollers, which are inclined at an angle equal to taper so that outer edge is maintained parallel to central axis. A pinion at end of each roller meshes with either a sun gear or a ring gear fixed to output shaft. Transmission also serves as an overload clutch as well as a speed variator and torque multiplier.

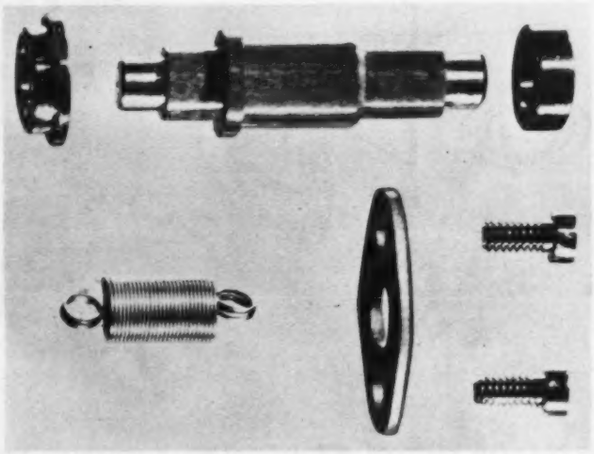
Graham Transmission, Inc., Menomonee Falls, Wis.

Nonfriction Bearing 302

Replaces Ball-Bearing Assemblies

A compact, nonfriction device for the industrial and aero-space fields is easy to install and requires only simple machining of mating parts for its installation. The device can be used in many bearing applications in which the angular movement required is 60 deg or less. Two types are available: a cantilever type to support an overhung load and a double-end support type to bridge-support a central load. Pivot consists of two concentric cylindrical sleeves with cutaway sections interconnected by two flat crossed springs. Outer sleeves are separated into sections along main longitudinal axis to permit relative rotation within specified range. A series of seven units of both types is available in diameters of 5/32, 3/16, 5/16, ¼, ⅜, ½ and ¾ inch. Other sizes are being tested—one smaller than a matchhead. Company also will design and build special types according to customer requirements.

Bendix Corp., Utica Div., Utica, N. Y.

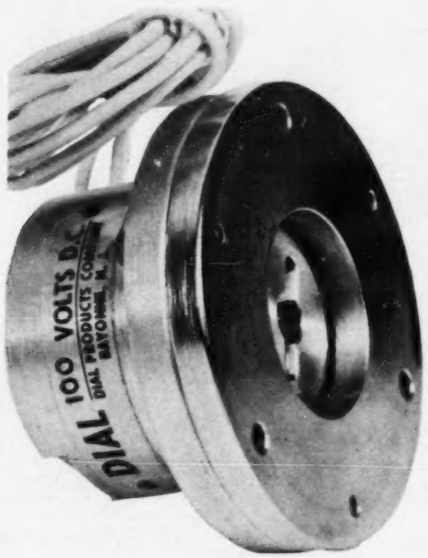


For more information on products described, circle on the Reader-Service Card the numbers appearing opposite the story headlines and drop the card in the mail.

Electromagnetic Brakes 303

For FHP Motors and Gear Trains

Miniature electromagnetic brakes, which brake when de-energized and release when energized, are currently available in two sizes. Size 100 has a body dia of 1-7/64 inches and a mounting flange dia of 1-9/16 inches. It has a braking



torque of 10 oz-in minimum and is rated at 2w power input. Size 130 has a body dia of 1-9/16 inches and a mounting flange dia of 2¼ inches. This unit has a braking torque of 30 oz-in minimum and is rated at 3½w power input. Standard voltages (d-c only) are 6, 12, 28, 48 and 100. Brakes can be mounted directly to motor frame, gear box case or any convenient surface where a shaft extension can be provided. An optional feature is a manual release which permits braking torque to be released when manual operation of equipment is required in case of a power failure or cutoff.

Dial Products Co., 19 Cottage St., Bayonne, N. J.

NAME YOUR STAINLESS SHAPE!

The design and manufacture of quality stainless steel castings is a specialized job . . . *and Dodge specializes in it!*

There is practically no limit to the variety of shapes we can turn out to meet your simple or intricate specifications precisely . . . economically.

Perhaps one or more DS castings shown here will help spark an idea of how Dodge can be of assistance for *your* stainless steel casting needs. A blueprint or sketch with operational details will bring complete information, without obligation.

DODGE STEEL COMPANY
6501 State Road
Philadelphia 35, Pa.
• *Phone: DEvonshire 2-2200*

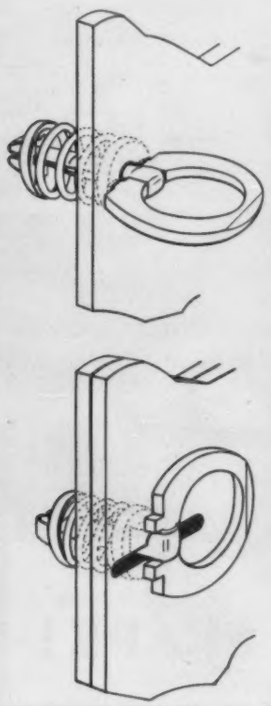
DS DODGE PRODUCTS

THE MOST IMPORTANT ALLOY IN A STAINLESS STEEL CASTING IS QUALITY

Circle 36 on Reader-Service Card for more information

Spring-Loaded Latch 304

An inexpensive spring-loaded latch is installed in one-fourth the time of conventional closures. The completely assembled unit is used in any application requiring a ¼-turn, sheet-metal type of fastener. Simple hole preparation eliminates riveting, screws, spot



welding or special tools. Spring tension eliminates noise transmission and vibration. Cadmium-plated, the latch has a wide application range accommodating thicknesses up to ¼ inch.

Monadnock Mills, San Leandro, Calif.

Circle 37 for Reader Service

OHIO *Round Tubing*
To 7-1/2" OD x .375" wall

See us at the
DESIGN ENGINEERING SHOW
Cobo Hall, Detroit—May 22-25

A-3573A

OHIO *Square Tubing*
To 6" x 6" x .259" wall

OHIO *Rectangular Tubing*
To 7-1/2" major diameter x .259" wall
Typical 4" x 6" x .259" wall section illustrated

Announcing Mechanical — Pressure — Cold Drawn

OHIO QUALITY WELDED STEEL TUBING

in larger sizes...heavier wall thicknesses

New sizes and heavier wall thicknesses of Ohio Quality Welded Steel Tubing (up to 7½" OD) now parallel the sizes of famous Ohio Seamless Steel Tubing. That means — now more than ever — there's a type and size of Ohio tube to fit your special requirements exactly. And since we make both types, we're in a position to recommend the best type for your own particular needs. Ohio Tubing — either welded or seamless — is just "made to order" for your product.

OHIO **OHIO SEAMLESS TUBE**

Division of Copperweld Steel Company • **SHELBY, OHIO**

Seamless and Electric Resistance Welded Steel Tubing • Fabricating and Forging

Cut along line and send air mail to save time.

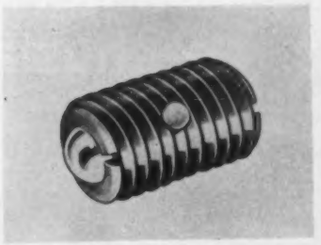
RUSH me, without obligation, latest information on new larger sizes and heavier wall thicknesses of Ohio Welded Steel Tubing.

Name_____ Title_____

Company _____

Address_____ City_____ State_____

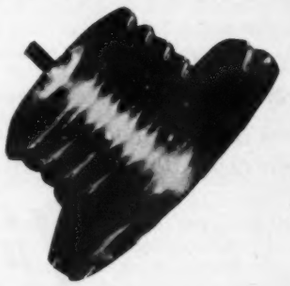
Stainless-Steel Ball Plungers 305



Spring-loaded ball plungers are now available in 10 sizes, manufactured in stainless steel. The plunger is widely used in indexing automatic-feed devices, for gear shifters, as locators in progressive dies, in torque-limiting clutches, for positioning levers in gages and anywhere a controlled end pressure is required. They are offered in sizes from 4-48 by 0.187 to ⅝-11 by 0.984 inch, and in various end pressures. They may be ordered with or without "Nylok".

Vlier Engineering Corp., 8900 Santa Monica Blvd., Los Angeles 46, Calif.

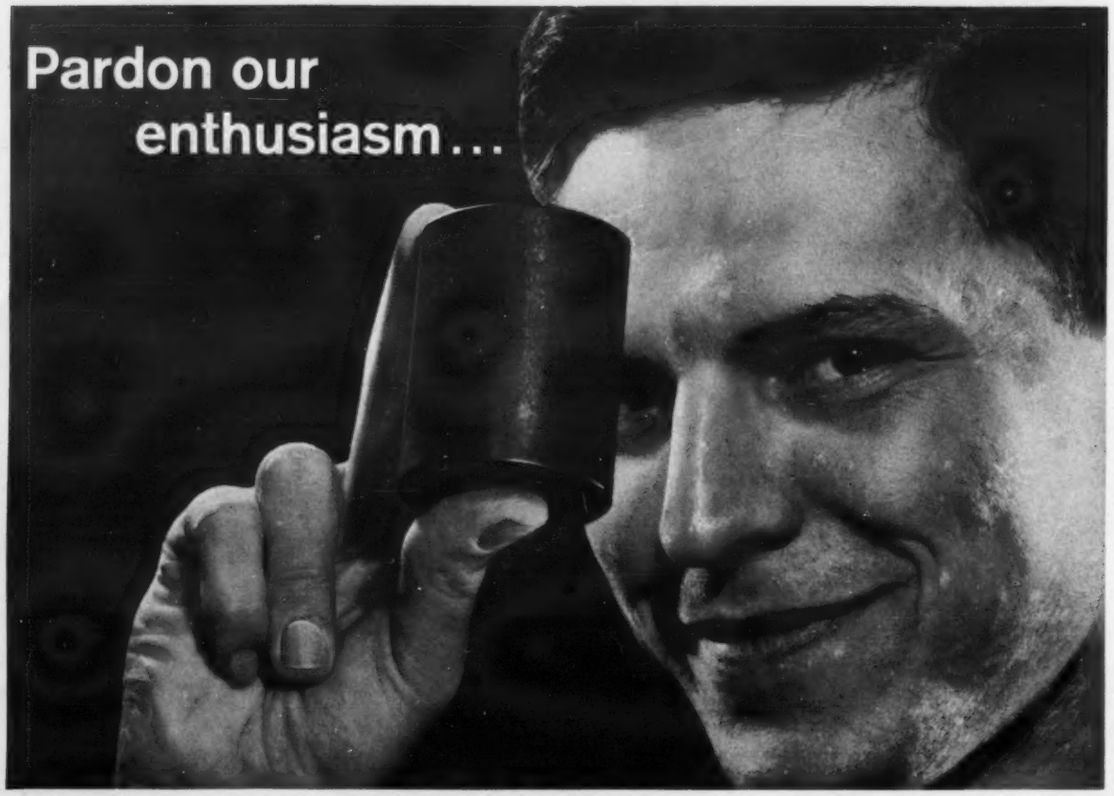
Hermetically Sealed Axial Seal 306



This seal provides a jewel-end bearing at each end of a gimbal within a fluid-filled gyro. It permits an axial adjustment of the gimbal for its proper orientation with respect to the gyro case. Bellows unit shown is 0.140 inch OD by 0.070 inch long and extends 0.025 inch.

Mechtronics Corp., Div. of MechMetal-Tronics Corp., 11431 Joanne Place, Culver City, Calif.

Circle 37 for Reader Service



Here it is. HI WEAR 64.
A brand new tool steel with wear resistance well above high carbon, high chrome die steels.
A deep hardening steel with low hardening temperature . . . good dimensional stability.
Maybe it will solve a design problem you're working on right now.
Maybe not.
But some day next week . . . next month . . . next year . . . you're going to balance a brilliant design idea against available materials to give it reality.
Then you'll remember Carpenter's HI WEAR 64.
Then you'll be glad you used this coupon today.

Carpenter steel

you can do it ***consistently*** better with Carpenter Tool and Die Steels

The Carpenter Steel Company
Main Office and Mills, Reading, Pa.
Export Dept., Port Washington, N. Y.—"CARSTEELCO"
Alloy Tube Division, Union, N. J.
Webb Wire Division, New Brunswick, N. J.
Carpenter Steel of New England, Inc., Bridgeport, Conn.

Steel

Attention: T. A. Washburn, Manager, Tool Steel Sales
The Carpenter Steel Company, Dept. 188, Reading, Pa.

☐ Send me HI WEAR 64 Technical Literature
☐ I'd like a sample of HI WEAR 64 for testing

Name_____
Title_____
Company_____
Street_____
City_____ Zone____ State____

Circle 38 on Reader-Service Card for more information

Plastic Cable Clamp 307

This assembly consists of a clamp in which the "Nylatch" fastener is held captive in one arm of clamp. Clamp is secured by pressing plunger in. This action expands fastener grommet behind supporting structure, locking assembly. Unfastening is accomplished by lifting plunger. Prelatching of clamp prior to installation eliminates need for tie wraps. The clamp, which can be fastened and unfastened indefinitely, is a "blind" attachment as installation is made from one side of supporting structure. Clamp will support loads up to 75 lb and can be used in temperatures from —20 to 150F.

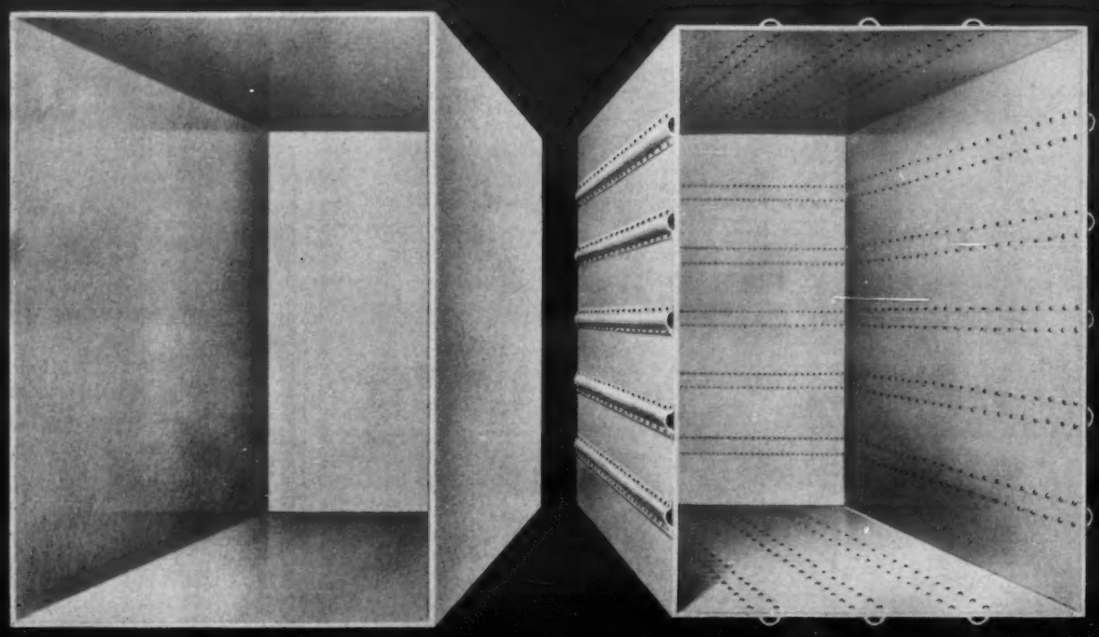
Hartwell Corp., 9035 Venice Blvd., Los Angeles 34, Calif.

Vapor-Contaminant Filter 308

A low-cost filter is available for removal of water vapor and other contaminants from air, nitrogen, oxygen and similar gaseous matter in pressure lines. The device provides a safeguard against contamination that may develop within the air lines. The unit is five inches in length and consists of a reusable desiccant filter, encased in a plastic shell, with molded vinyl tubing, four inches long on the receiving end and 44 inches long on output end. Both ends are fitted with NPT brass fittings for easy installation. Entire device weighs only ½ lb and is encased in an aluminum shell. Operating pressure is guaranteed safe to 75 psi. Rejuvenation of filtration unit is easily accomplished on a heated manifold at temperatures up to 120F.

A. Bierderman, Inc., 1045 Air Way, Glendale, Calif.

Circle 39 on Reader-Service Card



NO-RIB RIBBED

Thick-gauge magnesium sheet is so rigid that time-consuming rib stiffeners and fasteners are eliminated. Yet the magnesium panels are light and strong, resist dents and punctures better than thin-skinned ribbed construction.

WHICH HIGH-STRENGTH DESIGN WEIGHS LESS... COSTS LESS TO BUILD?

Magnesium no-rib, of course. By increasing the sheet thickness slightly, designers of containers and vehicle bodies get a tremendous boost in rigidity, thus can eliminate stiffening ribs. And since magnesium is the lightest structural metal, the resulting unit weighs less than conventionally-designed structures using other metals. (No-rib design in other metals introduces a severe weight penalty.) Magnesium no-rib structures are smooth-walled, minimize crevices for water seepage, have greater cubic capacity pound-for-pound than ribbed units. For detailed information on using magnesium no-rib construction for fabricated units of all types, write THE DOW METAL PRODUCTS COMPANY, Merchandising Department 1108DZ4-24, Midland, Michigan.

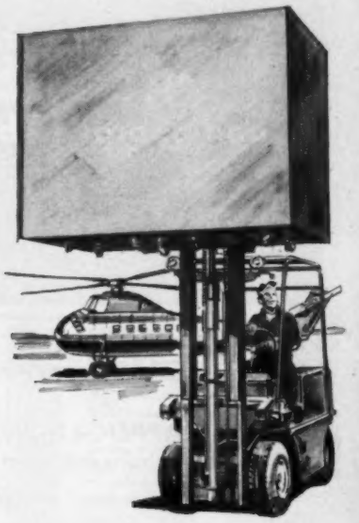
DOW

THE DOW METAL PRODUCTS COMPANY

Division of The Dow Chemical Company

DOW

HOW MAGNESIUM NO-RIB DESIGN CUTS CONTAINER COSTS AND WEIGHT



Cargo containers can be made both strong and light . . . and at less cost . . . with magnesium no-rib design. Fabricated from stiff sheets of lightweight magnesium, container walls need no stiffening ribs or supports.

No-rib design eliminates costly, time-consuming installation of ribs and fasteners . . . provides strong, dent-resistant walls that are smooth inside and out . . . produces economical containers that, pound-for-pound, have greater cubic capacity than ribbed containers of any other metal.

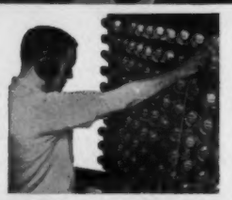
Dow magnesium sheet alloy ZE10A is ideal for no-rib construction.. It provides high welded-joint strength and *needs no stress relief* after welding. For equipment handling and cargo containers, storage bins, vehicle bodies, magnesium no-rib construction offers maximum strength at lightest weight . . . and savings in construction time and costs!

DOW

THE DOW METAL PRODUCTS COMPANY

Division of The Dow Chemical Company
Midland, Michigan

UL AND CSA APPROVED



IN-PLANT TESTING . . . Shown is a test rack, where some of the more than 50 tests are given to *every* Hansen SYNCHRON motor *before* shipment to customers.

PROBLEM:

Jamming of gears at low temperature operation

AREA OF APPLICATION:

Oil field telemetering instruments

The Foxboro Company, a leading manufacturer of telemetering instruments, experienced continuous difficulties with synchronous motors operating metering and transmission equipment. Many such installations were in the field where extreme climatic conditions made reliability of the timing motors a prime requisite.

TESTING:

Over a 6-year period various timing motors, including Hansen SYNCHRON motors, were subjected to constant testing for dependability of operation. Tests included: continuous operation . . . as long as one and one-half years; gear noise check . . . initially, and after extended running; synchronous torque tests . . . motors had to deliver 0.9 in.-oz. of torque at 30 rpm; a 1500-volt shock to check breakdown rating between leads and cases to meet UL and CSA approval; starting ability . . . motors were packed in dry ice (—40°F) for one hour, then had to start within five minutes; three hours continuous running in dry ice . . . again at —40°F; five hours uninterrupted operation in an oven at 140°F.

RESULT:

Only Hansen SYNCHRON timing motors **met all the exacting requirements!**

Hansen SYNCHRON timing motors were incorporated in all telemetering instruments produced, and singled out to replace motors on all applicable equipment now in use in the field. Foxboro is also reviewing over-all operations — to use Hansen SYNCHRON motors where possible on other instruments and controls.

If *you* must have performance in a synchronous motor . . . investigate Hansen SYNCHRON motors. Over 200 different types of output available. Hansen engineers will work with you to find a satisfactory solution to special application or design problems. For further information or assistance, contact the nearest Hansen representative or write direct to:

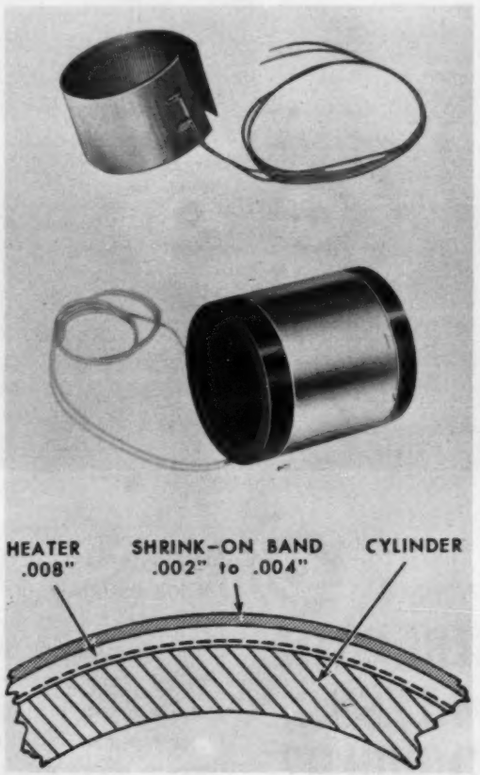
HANSEN MANUFACTURING COMPANY, INC.
PRINCETON, INDIANA

HANSEN REPRESENTATIVES: The Fromm Co., 5150 W. Madison St., Chicago, Ill.; Winslow Electric Co., New York, N.Y., Chester, Conn., Philadelphia, Pa., Cleveland, Ohio; Electric Motor Engineering, Inc., Los Angeles (WEbster 3-7591) and Oakland, Calif.; H. C. Johnson Agencies, Inc., Rochester, Buffalo, Syracuse, Binghamton, and Schenectady, N.Y.

Circle 40 on Reader-Service Card for more information

Shrink-On Flexible Heater 309

A flat-element flexible heater may be installed on cylindrical surfaces without using adhesives. The shrink-on band slips over heater and cylinder on which heater is wrapped. A few minutes in a 200-225F oven shrinks installation band to hold heater permanently and firmly in close contact with cylindrical surface to be heated. Heater is less than 0.008 inch thick, yet has high insulation resistance of well over 1000 megohms. Overall thickness of heater and band is 0.010 to 0.012 inch, excepting over leads where thickness depends on leads specified. When installed in this manner, only 0.001 to 0.002 inch of insulation separates flat foil heating element from surface of heat sink, resulting in maximum and rapid heat transfer. The noninductive "Thermofoil" elements can have up to 500 ohms per sq in resistance. Power dissipation can be up to 15w per sq in when heater is installed on heat sink and controlled to 200F or less.



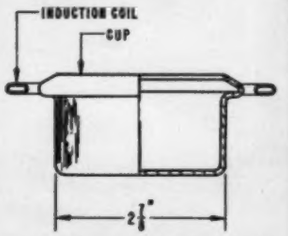
Minco Products, Inc., 740 Washington Ave. N., Minneapolis 1, Minn.

LepeL
HIGH FREQUENCY *Induction* HEATING UNITS

Lepel induction heating equipment is the most practical and efficient source of heat developed for numerous industrial applications

Typical Induction Heating Applications

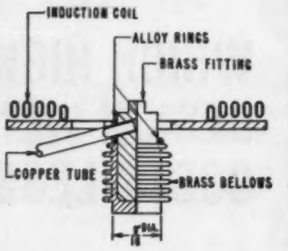
Stainless Steel Cups Selectively Annealed



Flanges of cups made from type 321 stainless steel are selectively annealed by induction heating prior to further forming. Flanges are heated to 2000° F and water quenched. Single-turn coil restricts heating to the flange area.

Our engineers will process your work samples and return the completed job with full data and recommendations without cost or obligation.

Bellows Assembly Brazed



Brass bellows and copper tube are simultaneously silver-alloy brazed to a brass fitting by induction heating. Plate-type induction coil produces proper temperature at each joint.

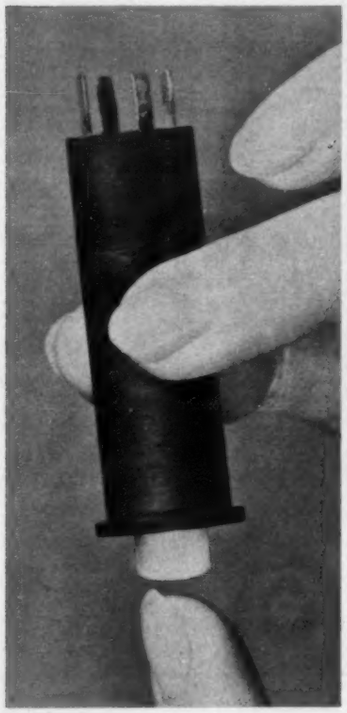
WRITE FOR NEW LEPEL CATALOG

LepeL HIGH FREQUENCY LABORATORIES, INC.
55th ST. & 37th AVE., WOODSIDE 77, N. Y.
CHICAGO OFFICE: 6246 WEST NORTH AVE.

Circle 41 on Reader-Service Card

Illuminated Indicator Switch 310

This illuminated switch provides a compact, low-cost switch package. The unit accepts lamps of 4, 6, 10, 12, 16, 24, 28 and 48v sizes. Five push-button colors are offered in red, yellow, green, white and blue. Colored push buttons can be replaced from front of panels. Lamps also can be replaced from front of panels. Switch is 41/64 inch in dia and mounts with a "Tinnerman" clip furnished with switch. Construction incorporates



four contacts for separate indicating and load circuits. Rating is 5 amps capacity at 250v. Terminals are "78 Series Amp-Faston Connectors" which are numbered to facilitate wiring. Switch is a SPDT unit with wiping contacts. Legend push buttons, lettered from A to Z or numbered from 0 to 9, also can be furnished at a small additional charge.

Sylvania Lighting Products, 60 Boston St., Salem, Mass.

Circle 42 on Reader-Service Card

AGAIN-

Shown here is the 6" Rapidaire Dolphin Submersible Pump, one of a complete line of 4" and 6" pumps made by THE TAIT MANUFACTURING COMPANY, Dayton, Ohio. Arrow points to the upper body shell made of Revere seamless leaded brass tubing. Hand holds the diffuser casing made of Revere Brass Strip and used inside pump.

Revere helps "fit the metal to the job"

AND A PUMP MANUFACTURER FABRICATES SUPERIOR PARTS WITH GREATER EASE . . . INCREASES TOOL LIFE

An important part of the submersible pumps made by Tait Manufacturing Company is the brass diffuser casing you see above. This part had formerly been made of ferrous metal. While satisfactory as a pump part it was difficult to work and draw . . . at the same time tool life was short.

One of Revere's Technical Advisors was asked to study the problem. Revere Cartridge Brass Strip of a certain temper was recommended, samples submitted, and, after extensive tests, was approved. The customer has found that not only does the diffuser casing, made of Revere Brass, perform well in the pump, but it also has superior drawing properties, is more easily worked, and tool life has been substantially increased.

This meticulous attention to "fitting the metal to the job" also resulted in Tait Manufacturing Company's specifying Revere seamless leaded brass tubing for the upper body shell of its submersible pumps. Here the application called for extremely close straightness and roundness control which meant special attention to detail on the part of the Revere mills.

Why not put the extensive knowledge of Revere's T.A. Service to work for you? With the wide variety of metals at your disposal, perhaps Revere can help you select the one best suited for the job, with a resultant saving of money while improving product quality.

COPPER • BRASS • REVERE • ALUMINUM • 1801

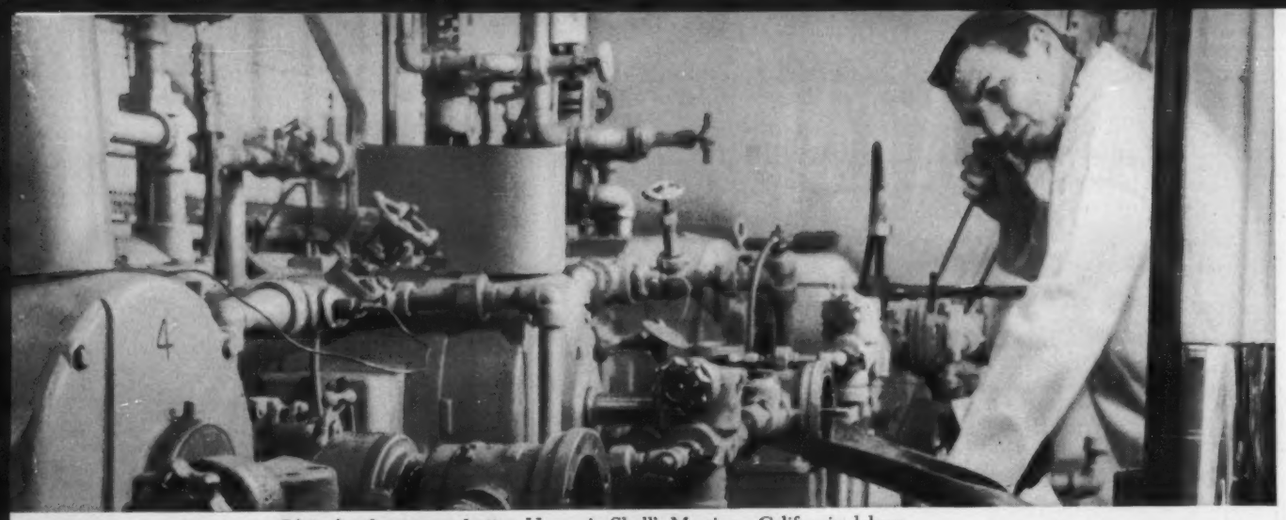
REVERE COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, N. Y.

Mills: Rome, N. Y.; Baltimore, Md.; Chicago and Clinton, Ill.; Detroit, Mich.; Los Angeles, Riverside and Santa Ana, Calif.; New Bedford and Plymouth, Mass.; Brooklyn, N. Y.; Newport, Ark.; Ft. Calhoun, Neb. Sales Offices in Principal Cities.

Distributors Everywhere



Listening for pump chatter. Here—in Shell's Martinez, California, laboratory Shell Tellus hydraulic oils are subjected to the most demanding tests.

BULLETIN:

Shell presents a question-answer guide to help you select the hydraulic oils for top performance

Selecting the proper hydraulic fluid for your equipment can be one of your most important decisions. And it can pay off in many ways. Less down-time. Longer equipment life. Lower cost per unit.

Here are six bench marks to help you pick the best hydraulic oil for your plant requirements.

1. Does it have good oxidation stability? Oxidized hydraulic oil can form gums, lacquers and other deposits which may foul moving parts. Shell Tellus Oils are carefully refined to remove unstable, sludge-forming components—then fortified with a Shell-developed oxidation inhibitor.

2. Will it resist foaming and emulsification? Pump chatter and erratic operation are often the result of pump cavitation, brought on by oil foaming. Tellus® Oils contain additives to help prevent foaming.

3. Does it fight rust and corrosion? It is difficult to exclude all moisture from a hydraulic system. And moisture can form troublesome rust. Shell Tellus Oils have been carefully compounded to resist corrosion.

4. What are its lubrication qualities in continuous service? Shell Tellus Oils form a clinging, oily film on mating metal surfaces. This maintains a constant guard against wear.

5. How does it react to temperature changes? This is a key factor in the performance of hydraulic equipment. Careful selection of the proper viscosity grade of Tellus assures satisfactory operation of your system over its entire temperature range.

6. Is it available in several viscosity grades? Shell Tellus Oils are available in a broad range of viscosity grades. There's a special grade for virtually every hydraulic requirement.

Ask your Shell Industrial Products Representative for facts on Tellus Oils. Or write: Shell Oil Company, 50 West 50th St., New York 20, N. Y.

A message to manufacturers of hydraulic equipment

There is a Shell Tellus Oil suited for your equipment.

1. Your customers can get Tellus Oils at Shell depots everywhere. Readily available throughout the world.

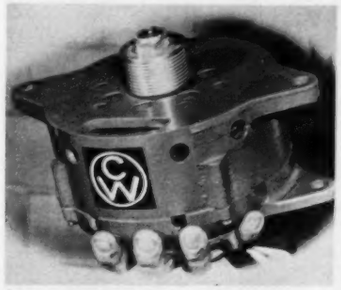
2. Quality is consistently high. Tellus always delivers top performance.

SHELL

A BULLETIN FROM SHELL
—where 1,997 scientists are working to provide better products for industry

Multipurpose 311 Alternator-Generator

This unit increases electrical power of automotive vehicles and makes possible economical, heavy-duty welding equipment for the home workshop. To the home craftsman this new development opens the possibility of greatly extending the number and types of jobs that can be done economically and efficiently. Coupled with either electric or gas-driven motor, the alternator makes possible an arc-welding unit which is competitively priced with comparable welders and weighs about one-third as much. In providing auxiliary power, the alternator can be coupled with one or two light-



weight gas engines to form a unit which can deliver from 10 to 20 kw for additional lighting and power needs. These units are hand portable, weighing from 30 to 60 lb. A complete line of alternators will be produced with converters ranging in size from 0.5 to 5000 kw. Among the models now in production is the 14Y05, which is 7 inches in dia, 5 inches long and weighs 14½ lb. It is available in 12 or 24v d-c at 100 amps and to 220v at up to 7.5 kw.

Curtiss-Wright Corp., Utica Div., 304 Valley Blvd., Wood-Ridge, N. J.

Circle 43 on Reader-Service Card

HEAT FAST

when and where you need it

HOTWATT® PRECISION
CARTRIDGE HEATING UNITS

give you the clean, fast, concentrated heat you need. A complete selection of sizes, sheaths, leads, terminals, wattage and voltage are offered to satisfy your most particular needs. And all Hotwatt Cartridges have these features as well as many others:

- ✔ Reliable operation.
- ✔ Precision-made stainless steel sheaths for stable, non-oxidizing contacts with cavities machined for these units.
- ✔ Designations are etched — not stamped — on sheath to preserve accurate shape.
- ✔ Standard units are moisture resistant — hermetic sealing on special order.
- ✔ Arrangement of heating element assures maximum heat transfer, minimum core temperature, and consequently faster heating.

Because of the exclusive design features of Hotwatt Cartridge Heating Units, they can be shipped to you faster . . . whether you order standard or special units in any quantities. Hotwatt also offers low-cost ceramic-body units to meet your specifications.

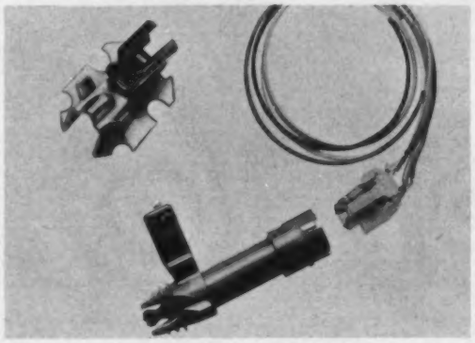
Get your free copy of this 12-page catalog with complete details on the Hotwatt line by writing today.

HOTWATT, INC.
75 MAPLE ST., DANVERS, MASS.

ELECTRIC HEATING SPECIALISTS

Circle 44 on Reader-Service Card

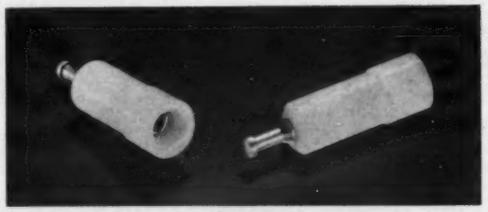
Audio Plug-In Cartridge 312



A plug-in audio cartridge is designed to play stereo, monophonic LP and 78-rpm records with equal fidelity. It is of the flip-under type of construction and makes use of a 0.7-mil stylus when playing either stereo or LP records and a 3.0-mil stylus when playing 78-rpm records. The entire assembly can be removed and a new one inserted without use of tools. The active element is a high-output ceramic transducer which is unaffected by either temperature or moisture. It is supplied in two models: CBS-1SS, which is equipped with sapphire styli and CBS-1DS, which is equipped with diamond/sapphire styli.

CBS Electronics, 100 Endicott St., Danvers, Mass.

HV Test Jack 313

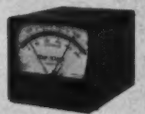


For installations requiring high voltage ratings, the "Press-Fit" type SKT-27 test-point jack provides a leakage path of 0.187 inch or more and is rated at 2000v rms at sea level. The component accepts a test probe 0.45 inch long by 0.093 inch in dia. The jack has a machined beryllium-copper contact with gold flash over silver-plate finish. It may be used over a temperature range of —55 to 200C. It is quickly and easily mounted on a drilled or punched chassis by means of simple insertion tools. It is also available in standard EIA colors as well as in white.

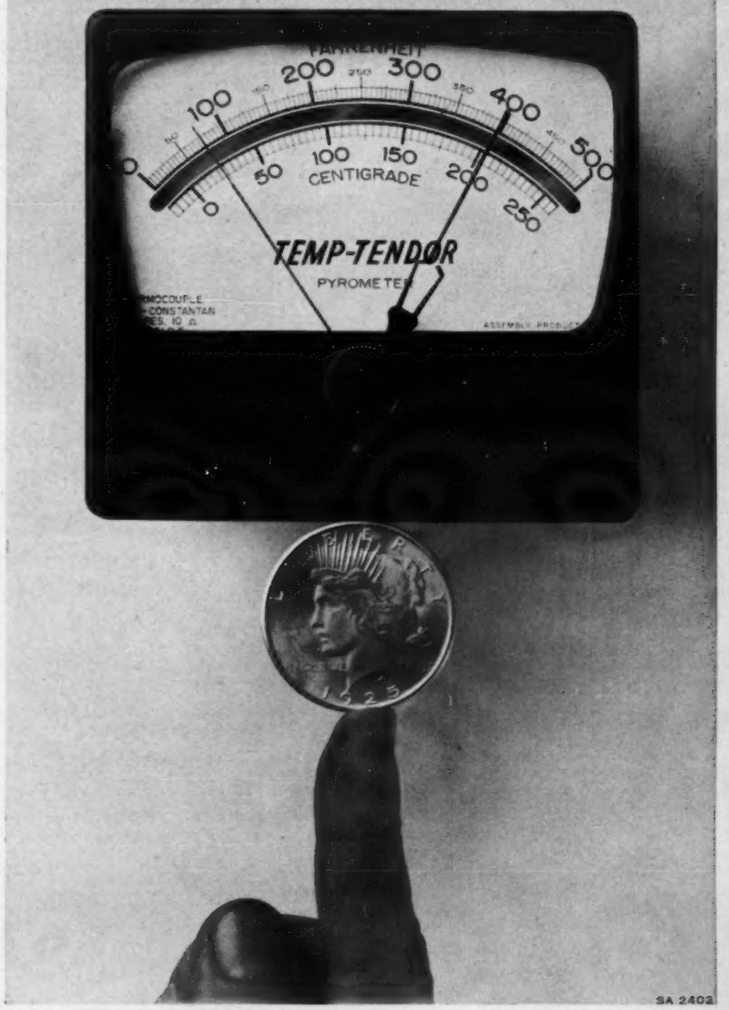
Sealectro Corp., 610 Fayette Ave., Mamaroneck, N. Y.

Here you see, at about four-fifths actual size, A. P. I.'s new and handily compact temperature control, the Model 450 Temp-Tendor. It's a natural for "built-in" jobs. Measuring just 4" x 4¼" x 5½" overall, it's as easy to mount as a panel meter, requires no more than a meter-sized panel space. And it goes for a remarkably low OEM price. • For your money you get: a time-proportioning control capable of maintaining temperature to within ±1°F. of set-point, with built-in t/c length compensation adjustment, t/c break protection, fail-safe circuitry, instantly adjustable set-point, and a number of other features usually found only in instruments many times Temp-Tendor's modest size and cost. Available in eight standard ranges, from 0-300°F to 0-2500°F. Our Data Sheet No. 24 will give you detailed specifications. Drop us a line, and we'll put a copy in the mail.

A NEW, SMALLER TEMP. CONTROL PRICED FOR THE OEM



ASSEMBLY PRODUCTS INC.
CHESTERLAND 18, OHIO



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LUNAR PROBE

The moon—lacking an erosive atmosphere—may hold the key to the history of the solar system. Because of this lack of atmosphere, oceans, and wind, lunar explorations may help solve fundamental, universal questions.

Logically, the moon will be the first objective in the exploration of space. Initially the moon itself will be photographed and instrumented; then manned observation stations will be established for astronomical and meteorological purposes. In time, the moon will serve as an intermediate station enroute to other planets—step by step into infinite space.

The National Aeronautics and Space Administration's Lunar Program will utilize Lockheed's AGENA B satellite to play a significant part in forthcoming lunar explorations—as well as a host of other scientific space missions. The NASA lunar launch in 1961-62 will utilize the highly reliable Lockheed AGENA as second stage to carry the RANGER spacecraft. The AGENA will provide the extremely critical guidance and controls necessary to place the RANGER on the required lunar impact trajectory.

The lunar probe application demonstrates the versatility, reliability and success of the AGENA vehicle in Lockheed's satellite and spacecraft programs. Developed for the Air Force for use in the DISCOVERER program, the AGENA is utilized in the MIDAS missile defense alarm system. Noted for a record of outstanding accomplishments, the AGENA is credited with being the first to be placed on a polar orbit; first to achieve a precise, predicted and nearly circular orbit; first to attain attitude control on orbit; first to eject a reentry capsule which was successfully recovered. The AGENA can be modified for a variety of space missions such as navigation, geophysical investigations, long-range communications and deep space probes.

Lockheed's capability in satellites and spacecraft, manifested by such an achievement as the AGENA, encompasses the entire field. It includes current and long-range programs such as interplanetary probes, global and space communication systems, and manned space travel.

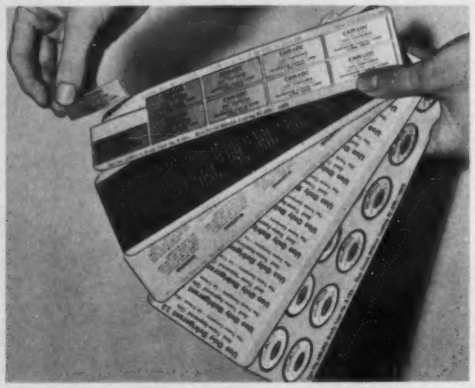
Engineers and Scientists: The accomplishment of such programs offers challenging opportunities to engineers and scientists in the research, design, development, test and operation phases of these programs. If you are experienced in work related to any of the above areas, you are invited to write: Research and Development Staff, Dept. M-29C, 962 W. El Camino Real, Sunnyvale, California. U.S. citizenship or existing Department of Defense industrial security clearance required.

Lockheed / **MISSILES AND SPACE DIVISION**

Systems Manager for the Navy POLARIS FBM and the Air Force AGENA Satellite in the DISCOVERER and MIDAS Programs

SUNNYVALE, PALO ALTO, VAN NUYS, SANTA CRUZ, SANTA MARIA, CALIFORNIA
CAPE CANAVERAL, FLORIDA • HAWAII

Self-Adhesive Nameplates 314



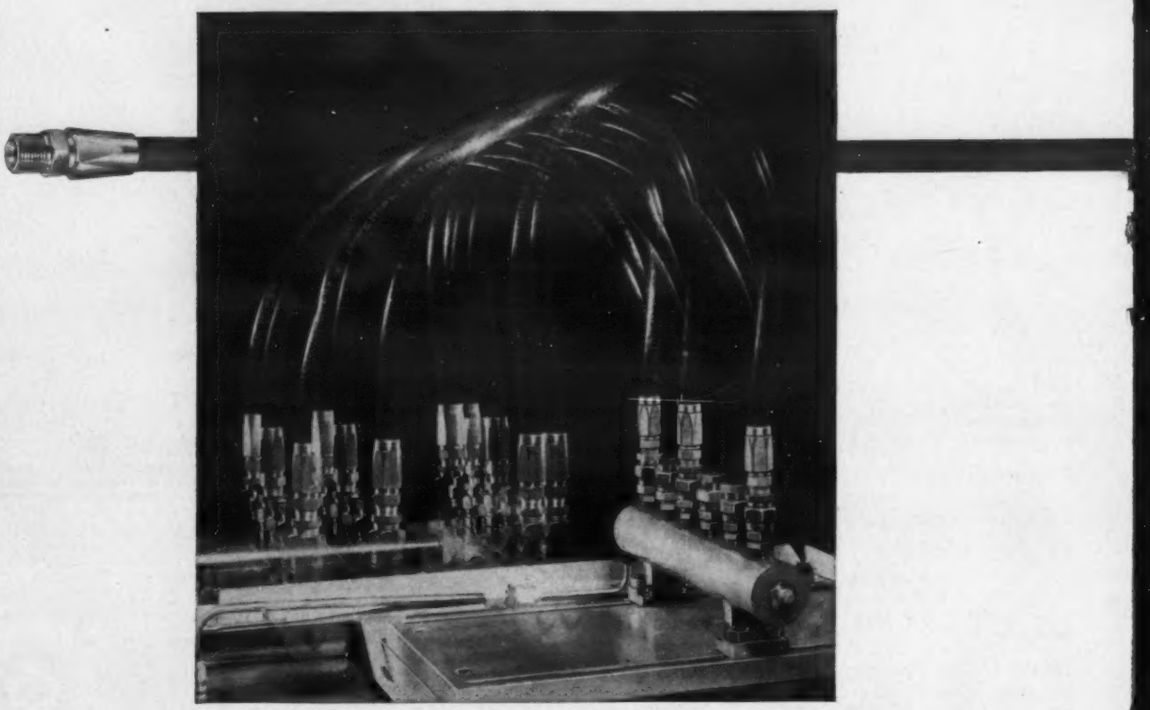
Mounted on dispenser cards for fast, easy application, low-cost nameplates are offered in aluminum foil and polyvinyl chloride. Foil nameplates are comparable to other types of metallic nameplates in appearance, permanence and physical properties. Made of 3-mil thin aluminum-foil material, they resist solvents, oil and dirts. They are heat-resistant to 350F. Vinyl nameplates are used wherever permanent color identification is desired. Made of 6-mil durable vinyl plastic, plates conform to flat, curved, irregular or compound-curved surfaces. Printing is unaffected by oil, moisture, abrasion or weather. Testing samples are available.

W. H. Brady Co., Dept. 702, 727 W. Glendale Ave., Milwaukee 9, Wis.

Self-Bonding Silicone Rubber 315

Silicone rubber compounds and reinforced gums afford a primerless bond to ferrous-containing metals. Designated SE-5504U, the material is a high-strength, low-temperature compound similar to SE-555. It is expected that this material will be of use to mechanical rubber fabricators in broad line processing and to specialty manufacturers for shock mounts, rubber rolls, oil seals and a variety of other products where high-strength, trouble-free bonds are desired. The material is a gray compound with a typical physical profile after cure of 25 hr/350F as follows: tensile strength, 1500 psi; tear, 200 psi; elongation, 550 percent; durometer, 50, and compression set 22/300F, 45 percent.

General Electric Co., Silicone Products Dept., Waterford, N. Y.



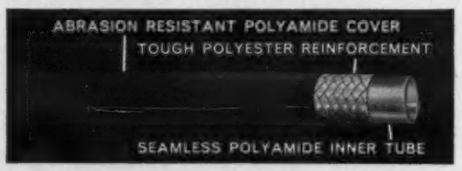
Hytron® hose delivers

7 TIMES THE FLEX LIFE

of wire braid hose

No need to pamper Hytron Hose. It lasts long, saves money on many applications. Hytron also has a wider range of uses than wire braid hose because it is more compatible to different fluids—mineral or synthetic fluids having a water or phosphate ester base.

Extra-long flex life and compatibility are *only two* of the outstanding advantages of Hytron Hose. For more information, see the next page. And write for detailed report and test results—Bulletin NEPR-500.



HYTRON

IMPERIAL EASTMAN

Imperial-Eastman Corporation General Offices: 6300 West Howard Street, Chicago 48, Illinois

Imperial-Eastman Corporation (Canada) Ltd., Barrie, Ontario • Imperial-Eastman, S.A., Apartado Postal 26544, Mexico 13, D.F.

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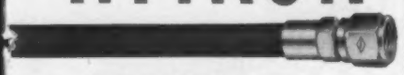
HYTRON



solves problems, meets more needs, cuts costs

Hytron Hose, made with a seamless, extruded inner tube of special virgin polyamide, has a high-tensile-strength polyester braid reinforcement, plus extruded polyamide cover. Its strength compares with wire braid hose—its *additional* features open new design opportunities in hydraulic and pneumatic systems.

Compatibility=more uses

Hytron Hose is compatible with mineral or synthetic fluids having either water or phosphate ester base. Thus, you can use this *one* hose for *more* applications. Wherever you use S.A.E. 100R1 wire braid hose, Hytron should be considered.

Major advantages

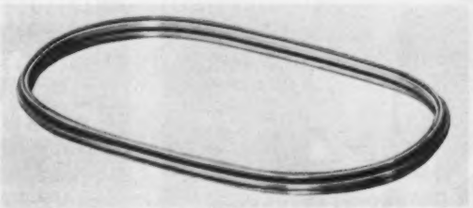
- 7.2 times the flex life of wire braid hose.
- 2½ times more abrasion-resistance than rubber. High resistance to mildew, heat, sunlight, chemicals.
- Burst pressures from 9000 to 12,000 psi, depending on hose size and temperature. Temperature ranges from −40° to 250° F.
- Available in long lengths—up to 1000 ft. Sizes to ¾ in.
- 60% lighter weight than wire braid rubber hose.
- Low diametrical expansion.

Hytron Hose furnished as factory-made assemblies with permanently attached couplings, or with easy-to-install, re-usable couplings, in a wide range of sizes and styles.

HOSE

IMPERIAL — EASTMAN

Oval-Type Static Seals 316



Contoured static spring seals are applicable in missile, aircraft and other liquid and gas conduction systems where extreme temperatures and pressures are encountered. The seal is made of silver-plated "Inconel-X" for handling temperature extremes ranging from —320 to 1500F. Spring action of seal is achieved from its bellows configuration created by machined grooves in heat-treated metal ring. Seal immediately resumes its original free length after it is released from compression, even under extreme conditions.

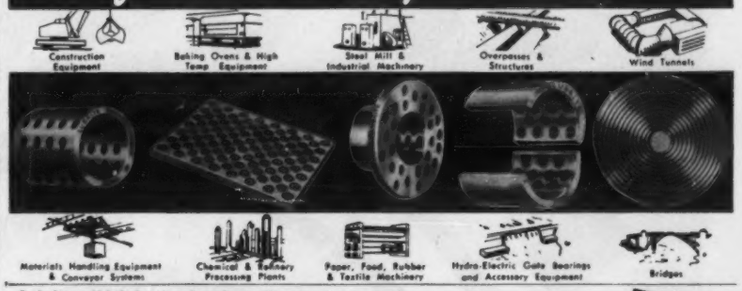
Hydrodyne Corp., 7350 Coldwater Canyon Ave., North Hollywood, Calif.

Antistatic Fluid 317

A new chemical fluid prevents build-up of static charges on plastic-faced instruments. Static electricity on meter and instrument windows deflects pointers, causes faulty readings and attracts and holds airborne dust and dirt. This antistatic fluid provides a thin, transparent coating which drains off static electricity. An active factor in the fluid is a long-chain molecule, highly attractive to plastic materials on one end. The other end of the chain consists of an ion (+) link which provides a good conductor independent of moisture. The liquid can be quickly and easily applied to plastic-faced instruments now in use.

Daystrom, Inc., Weston Instruments Div., 614 Frelinghuysen Ave., Newark 12, N. J.

ASSURED SELF-LUBRICATING SECURITY WITH LUBRITE® Self-Lubricating BEARINGS


Construction Equipment
Baking Ovens & High Temp Equipment
Steel Mill & Industrial Machinery
Overpasses & Structures
Wind Tunnels
Materials Handling Equipment & Conveyor Systems
Chemical & Refinery Processing Plants
Paper, Food, Rubber & Textile Machinery
Hydro-Electric Gate Bearings and Accessory Equipment
Bridges

Lubrite self-lubricating bearings offer great versatility in hundreds of fields where dependability and superior performance are of prime importance.

Lubrite Bearings, with clean, permanent, maintenance-free self-lubrication are designed to withstand severe loadings, temperature extremes, submersion, corrosion and other adverse conditions.

Lubrite may be just the bearing you need in your designs to obtain better results.

Consult our Engineering Department on your application. No obligation.

Send for this free 20-page Lubrite Manual No. 55—it contains complete information, technical data and specifications about Lubrite Self-Lubricating Expansion Plates and Bushings. Write today!

Now Available—New Manual No. 56 with complete technical information about LUBRITE SELF-LUBRICATING BUSHINGS, BEARINGS & WASHERS.

Write for your copy.

LUBRITE DIVISION
MERRIMAN BROS., INC.
198 AMORY STREET, BOSTON 30, MASSACHUSETTS

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DISCERNING DRAFTSMEN THE WORLD OVER DEMAND IMPERIAL THE WORLD'S FINEST TRACING CLOTH

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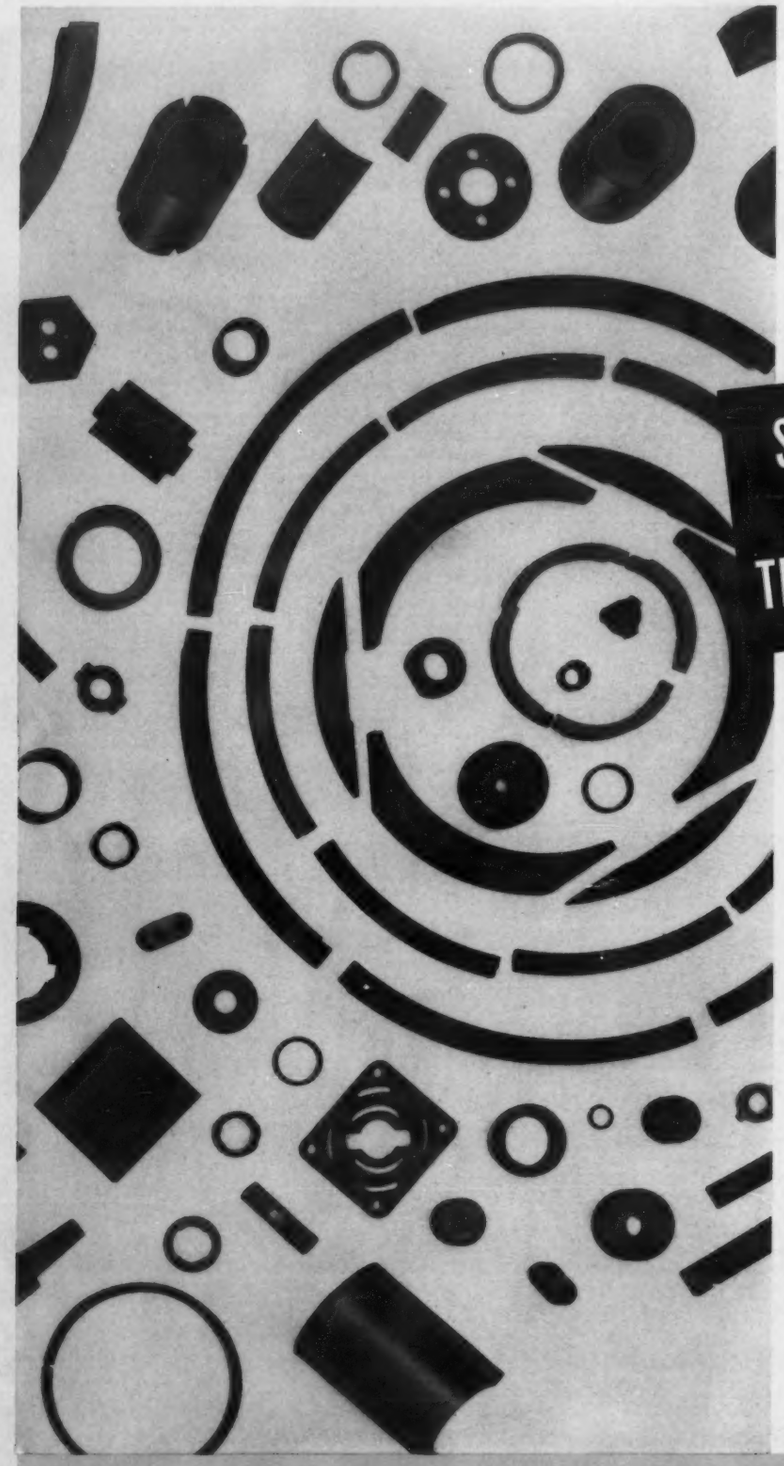

REQUIRE...

STABILITY AT HIGH TEMPERATURES?

TRY *PUREBON!

*CARBON-GRAPHITE ESPECIALLY DESIGNED FOR MECHANICAL APPLICATIONS

Sliding or rotating components compounded and molded of ***PUREBON*** are unusually stable at high temperatures, self-lubricating and light in weight. Further, this material is chemically inert, moldable to size and readily machinable . . .
Try ***PUREBON!***

Request Catalog #60 or see Sweet's Product Design File

PURE CARBON CO., INC. 448 Hall Avenue St. Mary's, Penna.

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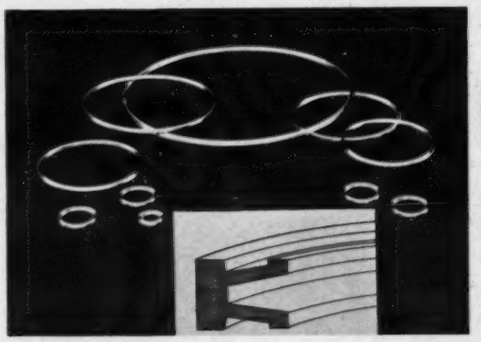
Pressure-Sensitive Plastic-Coated Paper 318

A low-cost, decorative, pressure-sensitive material simulates leather and other decorative trims and is available in a variety of colors, styles and embossing patterns. The "Pyroxylin"-coated paper has a wide range of other uses, especially for low-cost unit consumer items requiring highly decorative trim. Material adheres to most surfaces with finger-tip pressure and requires no moistening or other type of activation.

Avery Label Co., 117 Liberty St., New York, N. Y.

Metallic Static Face Seals 319

Wherever static sealing problems exist which elastomers cannot solve, the HS series seal can be utilized to provide zero leakage at a wide range of temperatures from —450 to 2000F and pressures to 20,000 psi. Liquids and gases are sealed in valves, actuators, missile and rocket engines, couplings, filters and in any category where temperature, vibration, pressure and expansion are critical. Seals are manufactured in

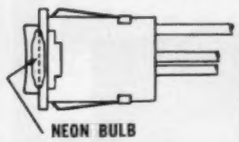


"Inconel-X", A-286, 17-4PH to H1150, 7056-T6 aluminum, 18-8 CRES, and tantalum. Maximum sealing forces are assured by design of seal as sealing faces are located at minimal diameter, exposing greatest possible area to system pressure. Seals are reusable, light in weight, have no storage or age-life problems and are available in a wide range of sizes from miniature to large diameter.

Haskel Engineering & Supply Co., Haskel Seals Div., 1236 S. Central Ave., Glendale 4, Calif.

NEW illuminated panel switch

- UL APPROVED 2 amps 115 V a-c
- Combination Light and Switch
- Low Cost per unit



Designed for functional beauty — with unlimited button and trim ring color combinations. Unique snap-in mounting available for panel installations from 1/32" to 7/16" thickness. Diffused lens.

Legend identification on button available. Switch is available in push-on-push-off or momentary contact units. Specials up to 6 amp rating.

For complete details . . . write to

molex MOLEX PRODUCTS CO.
9515 Southview Ave. • Brookfield, Ill.
HUnter 5-5881

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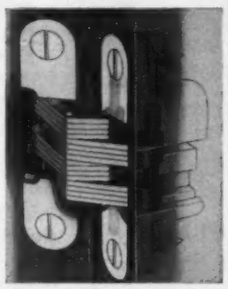
NEW INVISIBLE HINGES

General Purpose Hinge Creates Flush Surfaces



These hinges are completely hidden from view when door, lid or hood is closed. Makes possible flush, absolutely smooth surfaces that greatly enhance appearance and safety. Tapered body sections are precision castings of a special zinc base alloy having a tensile strength of 47,000 pounds per square inch. Operates in a 180 degree arc which permits full opening. Laminated link construction reduces friction and permits hinges to operate freely and smoothly. Hinges are reversible and may be used right or left hand. Available for wood or metal application in a wide variety of sizes.

SOSS MANUFACTURING COMPANY, Dept. DN-28, P. O. Box 38, Harper Station, Detroit 13, Michigan.

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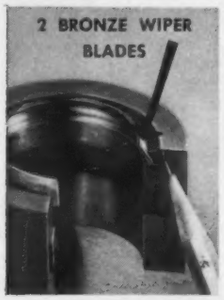

SEAL-GUARD®

keeps dirt, grit, water outside your cylinders

SEAL-GUARD keeps hydraulic and pneumatic systems clean—protects rods and packings—saves hydraulic fluids. Two bronze blades scrape rod clean and throw off foreign matter as rod enters cylinder. Rubber retainer ring absorbs shock, keeps blades in full contact with rod and provides an over-all outside seal. Compact, efficient, economical. **Write E. F. Houghton & Co., 303 W. Lehigh Ave., Philadelphia 33, Pa.**

Houghton
INDUSTRY'S PARTNER IN PRODUCTION

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COES KNIFE CO.

Your source of:

MACHINE WAYS

To increase production . . . improve quality of products . . . lower production costs . . . use Coes hardened-and-ground steel ways, guides, and wear plates. Built in all sizes and shapes to meet your specifications.

MACHINE KNIVES

Standard and special blades of solid or composite steel, for all machine knife applications.

COES KNIFE COMPANY
73 COES ST., WORCESTER, MASS.

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this FREE ENGINEERING MANUAL

tells why tOtal 2 solves all retaining ring PROBLEMS!

E-RING DESIGN • SPECIAL RING SHAPES • STACKED RINGS

With Ramco's Circolox and Spirolox you have the t0tal 2 designs needed to solve all retaining ring problems. This Free Engineering Manual brings you the complete t0tal 2 story—write for it today!

RAMSEY CORPORATION *a subsidiary of Thompson Ramo Wooldridge Inc.*
Box 513, Dept. A, St. Louis 66, Missouri

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Order Eaton Caps and Filler Necks from STOCK

Let us carry the inventory

Immediate delivery on caps and filler necks now in production. Types and sizes for every use—automotive, marine, aircraft, tractors, motorcycles, lawn mowers, industrial engines. Genuine original equipment quality. Take advantage of our high-volume production—and save. Send for illustrated folder with specifications covering complete Eaton line.

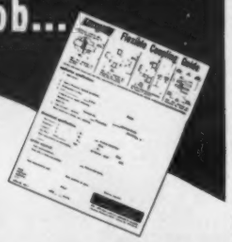
EATON STAMPING DIVISION MANUFACTURING COMPANY
17877 ST. CLAIR, CLEVELAND 10, OHIO

Circle 54 on Reader-Service Card for more information

To Get The Flexible Coupling Best Suited For Your Job...

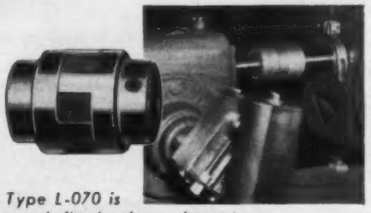
use the **Lovejoy**

Flexible Coupling Guide

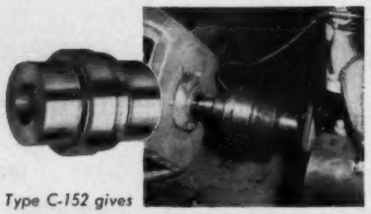


Save time, money and mistakes, insure trouble-free performance . . . by using the Lovejoy Flexible Coupling Guide. You'll get the exact type and size for your particular application —*plus all these Lovejoy features:*

- No lubrication required.
- Simple, rugged construction—few parts, no intricate mechanisms.
- No wear on metal parts—the load is transmitted through cushions only.
- Double-life cushions—one half the cushions act as idlers, except on reversing loads. Thus, a quick interchange provides a new set of cushions.
- Cushions engineered to load and service conditions.
- A maintenance-free coupling that is completely machined for ease and speed of alignment.

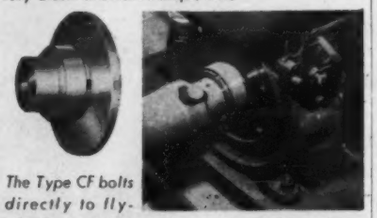


Type L-070 is exactly fitted to the requirements of this gear pump.



Type C-152 gives maintenance and trouble-free performance in a portable power unit.

A genuine selling feature of this centrifugal pump is the spacer type RRL which permits quick, easy disassembly without disturbing piping. (Courtesy Dean Brothers Pumps, Inc.)



The Type CF bolts directly to flywheel, reducing component requirements, cutting assembly time and providing a more compact unit.

● **Act now! Send for your Flexible Coupling Guide today.**

REQUEST CATALOG

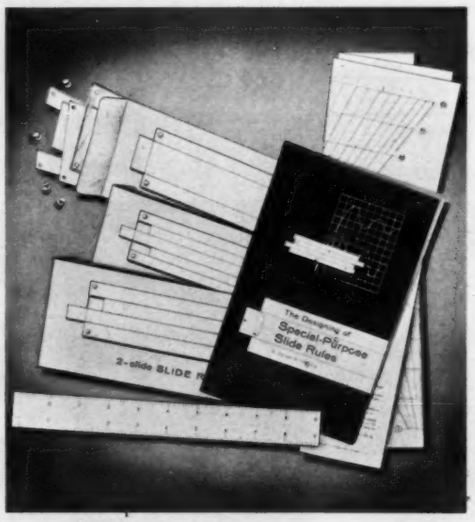
LOVEJOY FLEXIBLE COUPLING CO.

4812 WEST LAKE STREET • CHICAGO 44, ILLINOIS

Circle 47 on Reader-Service Card for more information

Slide-Rule Kit 320

This kit enables an individual to design and construct his own special-purpose slide rule for doing recurring calculations connected with his work. An illustrated booklet of instructions shows how to assemble different types of slide-rule blanks from the parts included in the kit. The 25-page booklet also explains the theory of slide-rule design and gives stepwise procedures on how to express almost any type of problem or equation on a special-purpose slide rule. Each kit contains the parts for making three basic slide-rule blanks (and many variations as well), a plastic scale-plotting ruler, a universal logarithmic chart and instructions. The slide-rule blanks have 1, 2 or 3 slides and are constructed of top-quality drawing cardboard and plastic to provide a superior surface for plotting and inking scales and to give the finished slide rule long-lasting usefulness. The assembled slide rules are 3 by 11 inches. The special ruler and logarithmic chart simplify the calculating and plotting of scales. Because of its simple and direct operation, slide rule saves calculating time and reduces chance for errors.



Dyna-Slide Co., 600 S. Michigan Ave., Chicago 5, Ill.

high performance

small size

FIKE

custom made rupture units relieve overpressure — act as quick opening valve

Fike custom rupture units are ideal where space, weight or special installation problems are encountered. The rupture unit will relieve overpressure or act as a quick opening valve by rupturing precision made metal rupture discs at a predetermined pressure.

Units ⅜" to 1⅜" in diameter with ⅛" to 1" rupture discs are illustrated above. Depending on the application, rupture pressures of 200 to 10,000 PSIG are possible.

Other special assemblies can be provided for a specific requirement. We welcome inquiries on special and unusual applications.

Fike

METAL PRODUCTS CORP.

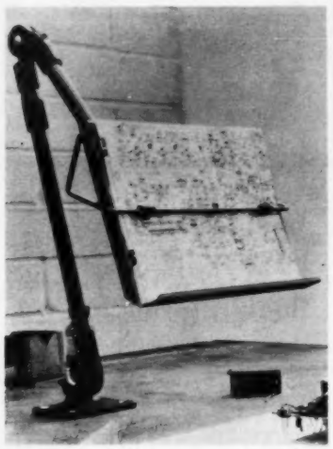
Dept. DN

Blue Springs, Missouri

Circle 57 on Reader-Service Card

Schematic Holder 321

This time-saving device increases valuable work space and creates greater efficiency for line soldering and assembly work. The holder is adjustable over the work area for height, viewing distance and lateral swing. Height adjustment is made with two positive-locking, telescopic rods. The unit can be locked firmly in any position with a turn of a knob. Adjustable cast-aluminum base plate can be fastened to top or side of bench and has been drilled for



3/16-inch mounting bolts. Its tray is adjustable to any position laterally or vertically through 360-deg swing and features a spring-loaded, hold-down rod with rubber bumpers. Fittings are cast aluminum and have positive locking action to assure rigidity. Applications include machine-shop equipment, electronic assembly, drafting projects, wiring and printed-circuit assemblies.

Beach Mfg. Co., 2000 S. Santa Fe Ave., Compton, Calif.

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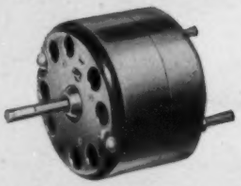

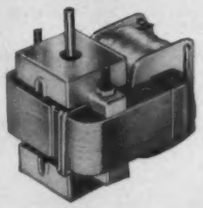

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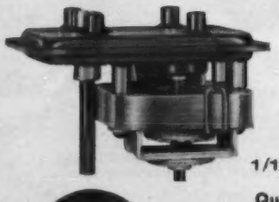

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Quantity Price Quotation on Request

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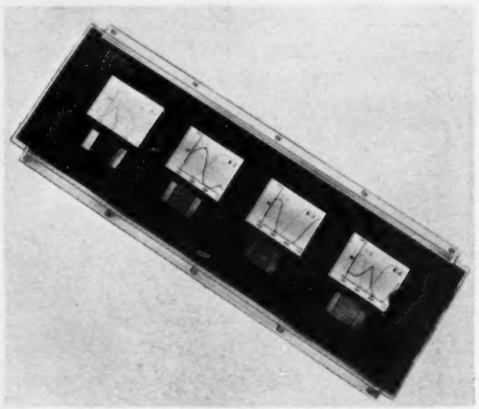
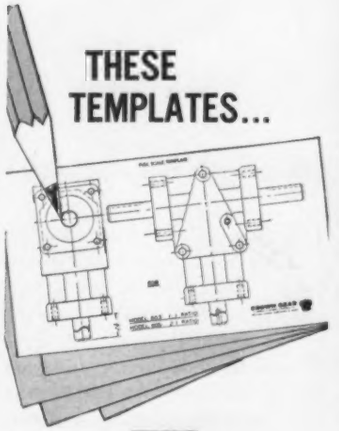
Subtractive Color Slide Rule 322

A slide rule which demonstrates the components of different colors will find application in lectures at high school and college physics level. The "Filtergraph" consists of a stationary holder with four filters, four corresponding color-coded spectrographic diagrams and a slide that moves within the holder. This slide has another set of four filters with four corresponding diagrams. Filters are arranged in a manner to permit observation of two individual colors and the subtractive color simultaneously with the corresponding spectrographic curves. Any combination of individual filters on the slide and stationary holder can be arranged quickly. The complete rule fill fit into a standard lantern slide projector for use in large lecture rooms. Eight colors can be shown to intermix variously into 16 additional colors. In a study of yellow and orange filters, it can be shown that the color differences between the two result from orange transmitting less green than yellow does, not from transmitting more red. The same filters and their spectrophotometric curves can be used for simultaneous projections by two lanterns to study additive color mixtures.

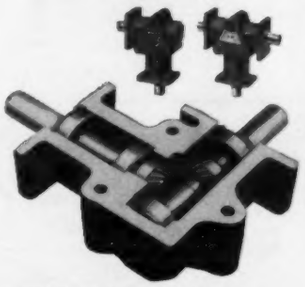


Central Scientific Co., Div. of Cenco Instruments Corp., 1700 Irving Park Rd., Chicago 13, Ill.



THESE TEMPLATES...

THIS **CROWN** "PACKAGE"



wrap up your right-angle design problem!

. . . And the transition to the "Package" concept of right-angle power transfer is that simple with this easy-reference template kit. 18 basic Crown right-angle units are shown on six template sheets, each full scale.

WHY spend countless hours on research and drawings? **WHY** purchase expensive patterns, core boxes, castings, steel and other materials? **WHY** manufacture fixtures and gages? **WHY** machine, inspect, assemble and test components?

WHY NOT OBTAIN THE IDEAL SOLUTION TO YOUR RIGHT-ANGLE PROBLEM . . . IMMEDIATELY, AND AT TREMENDOUS SAVINGS?

Your local Crown Gear Distributor (Listed in Power Transmission Design Directory) has the answers . . . and your Template Kit. Call him or consult factory.

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A Division of Harrington & Richardson, Inc.

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When your new product requires flexibility in conveying air, water, steam, gases, volatiles, granular, abrasive or light solid materials, specify Penflex. It's the flexible metallic tubing with complete engineering service from design board to the job installation.

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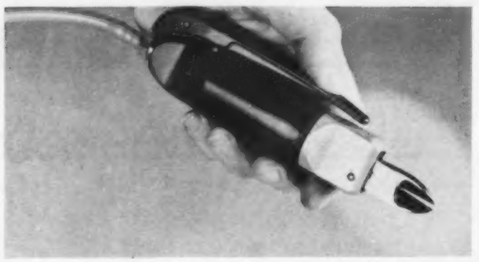
Pennsylvania Flexible Metallic Tubing Co., Paoli, Pa.

Penflex

TIGHT AS A PIPE BUT FLEXIBLE

Circle 61 on Reader-Service Card

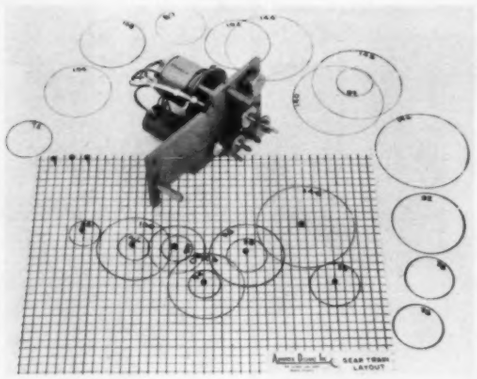
Air-Powered Wire Cutters 323



Requiring less pressure to operate than conventional hand pliers, featherweight "Air-Nips" eliminate operator fatigue normally associated with manual wire-clipping work. Weighing only six oz, hand-sized cutters will snip soldered portions of 14-page copper wire. Units feature a cutting head that can be rotated 180 deg for hard-to-reach leads on printed-circuit boards. Constructed of forged carbon vanadium steel, precision ground and hardened, rugged cutting head is replaced easily.

Chicago Pneumatic Tool Co., 6 E. 44th St., New York 17, N. Y.

Gear-Train Layout Kit 324



The layout of precision gear trains can be made easier and faster without erasing and redrawing or using paper cutouts. With this kit, several layouts can be made in less time than it usually takes to make one by other methods. In most cases, layout drawings can be eliminated completely by transferring gear location dimension from precision grid board directly to an assembly drawing. Each kit contains one 8- by 10-inch layout board marked with 1/10-inch-square grids; 10 center pins color-coded for identification and 100 transparent gear discs. Kits are available in 48, 64 and 96 diametrical pitch.

Advanced Designs Inc., 914 Lullaby Square S., Vienna, Va.

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VICTOLEX is a new multipurpose sheet packing developed from a blend of cellulose fiber and synthetic rubber. In toughness, strength and resiliency, it beats ordinary glue-glycerin treated paper packing. Victolex has good dimensional stability — won't shrink, stretch, dry out or break down under pressure or heat—and has excellent sealing characteristics for oil, fuel, antifreeze and water. Victolex is available in gaskets cut to your specifications or in rolls, in four thicknesses. Choose from ten grades, all conforming to the new SAE-ASTM specifications. Test samples supplied free. Please state proposed application; recommendations made if desired.

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ELECTRONIC • PRINTED CIRCUIT • GRAPHIC

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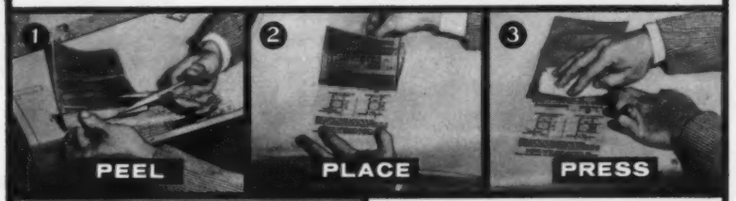
STANPAT tri-acetate sheets are quickly and easily adhered to your tracings without special equipment. Reproductions are crisp and clean . . . Won't dry out, come off or wrinkle. Mail the coupon today and see for yourself.



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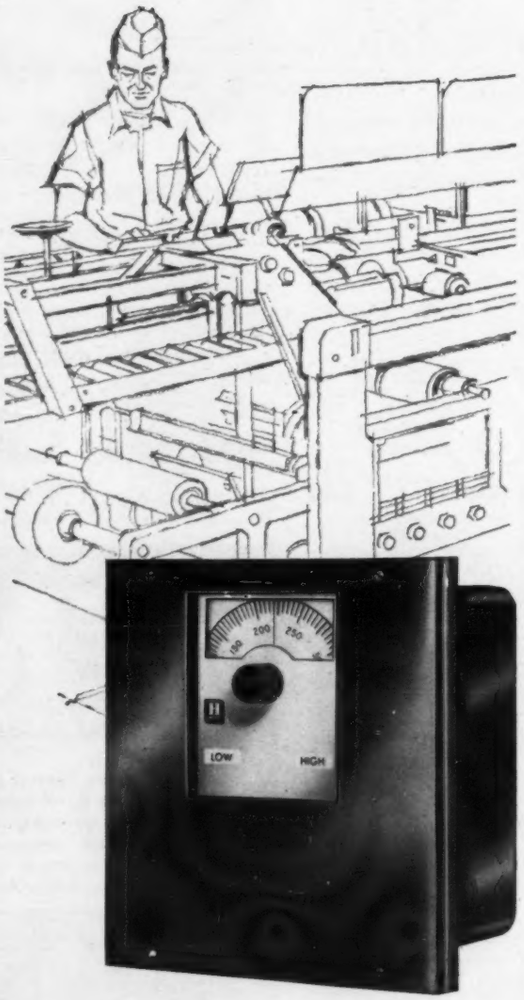
Grid Board Kits 325

"Fotoceram" grid boards have been combined into kits that provide a designer with all materials needed to make prototype printed circuitry in 15 minutes without leaving his desk. Kits contain etching resists and etching materials that work best with copper-clad glass-ceramic. Grid boards are studded with 0.052-inch holes in a 0.1-inch grid, making circuit and component layout highly manageable. Users etch away copper metallizing on boards except where circuit runs and pads are desired. The kits contain two

3- by 5-inch boards, grid paper for practice layouts, liquid etching resist for board circuit layout, vinyl resist tape, two bags of ammonium persulfate crystals for making etching solution, instructions, a price list for reordering individual processing materials, sources of alternative materials, addresses of suppliers, and a list of compatible tube and transistor sockets, connectors and miscellaneous hardware.

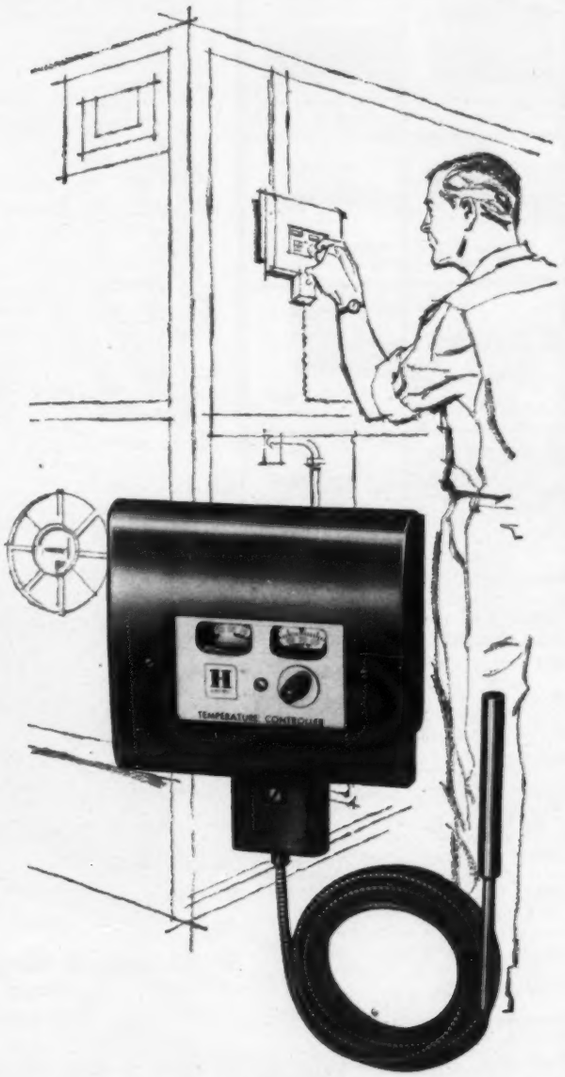
Corning Glass Works, Corning, N. Y.

Whether you choose by specification, price or both... **There's a Honeywell pressure control**



☐ **For precise control at low cost—R7086—R7087**

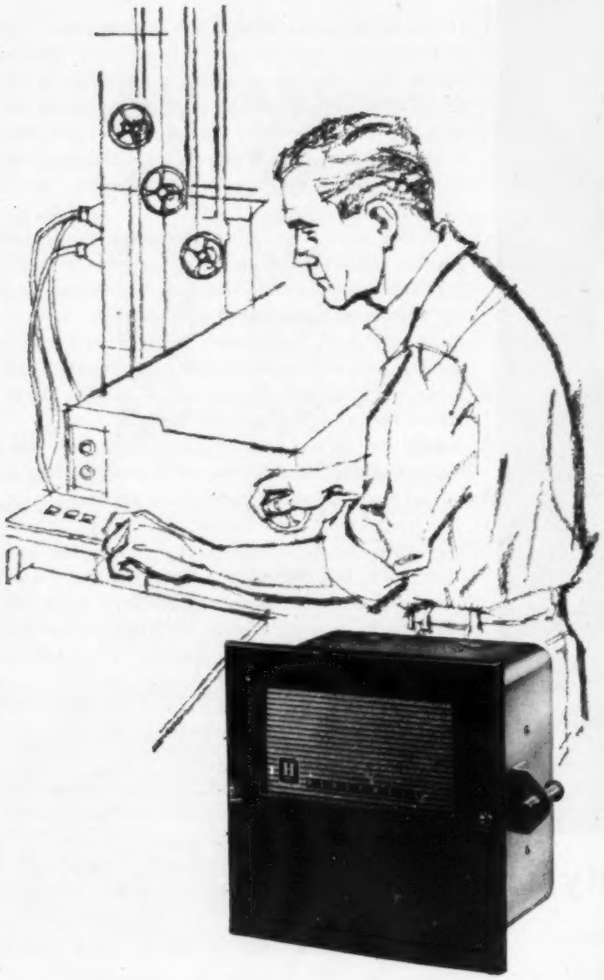
Temperature controllers for use wherever precision temperature control must be maintained. Ranges from —150° to +3000° F. are possible. R7086 uses thermocouple, R7087 uses resistance bulb. Both, surface or flush mounted. R7086 $150.00; R7087 *only $120.00.*



☐ **For accurate control with indication at low cost**

T654A indicates and controls temperatures on an evenly graduated scale accurate within 1% of scale range. This switch can control an *Actionator**, motor, relay, contactor or other device. Completely compensates for ambient temperature changes. Ranges from —150° F. to 1200° F.

temperature or to fit your exact needs!



Whatever your application, you'll find the control that suits you best in Honeywell's complete selection

P444
For industrial applications that call for independent high-pressure and low-pressure settings and switching action. Adaptable for surface or flush mounting.

T444
For a wide variety of industrial applications requiring independent high-temperature and low-temperature settings and switching action. Adaptable for surface or flush mounting. Ranges from 0° F. to 660° F.

P428
For general industrial applications requiring the control or limiting of relatively high pressures. Models are made with explosion-proof case for hazardous locations. Ranges from 30 PSI to 5000 PSI.

T667
Designed for use as a remote-bulb temperature controller. SPDT switching provides temperature control in heating, cooling, or heating-cooling commercial and/or industrial applications. Ranges from —150° F. to 1200° F.

☐ For reliable control at minimum cost—VERSA-TRAN

This inexpensive controller is completely transistorized. Needs no tubes, no warm-ups . . . gives instant reaction. Works with sensors that can be thermisters, probes, resistance bulbs, pressure transducers or humidity elements. Available in various temperature, humidity and pressure ranges. *Standard models as low as* $39.50. Model shown above only $49.50.

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Low-Band Mobile Radio 326

A 20w low-band mobile radio set utilizes single-unit construction with all operating controls conveniently located on front panel. The 7N20/TVR has provision for a local and remote control and plug-in installation of "Unicall" at any time in the field. ("Unicall" is Aerotron's selective call system which permits sharing of crowded frequencies without interference.) The transceiver is housed in a deep-drawn aluminum cabinet which can be mounted easily on dashboard of a vehicle or in luggage compartment. The unit may also be used as a fixed station. The power supply operates from 6 and 12v d-c and 115v a-c.

Aeronautical Electronics, P. O. Box 6527, Raleigh, N. C.

Torque Screwdriver 327

An oz-in torque screwdriver in both fixed-setting and adjustable models has a torque range from 4 to 100 oz-in. Adjustment is made by setting a micrometer-type dial located in the neck of the tool. The device contains a ¼-inch square-male drive, is 6½ inches overall and weighs only 8 oz. The fixed-setting model, designated TS-SN1, has a torque range from 1 to 100 oz-in, is 5 inches overall and weighs only 6½ oz.

Hunter Tools, R. N. Hunter Sales Co., 9851 Alburtus Ave., Santa Fe Springs, Calif.

all stamped with the T-MARK of total reliability

Other spring fasteners may *look* like Tinnerman SPEED NUTS. But only those stamped with the T-mark really *are* SPEED NUTS, made to Tinnerman's high, precise standards of reliability. Tinnerman quality controls are the most stringent in the industry. And only Tinnerman stocks a *half-billion* SPEED NUTS . . . is tooled to turn out 10,000 variations . . . develops 25 *new* designs each week. Protect your product's good name by insisting on genuine SPEED NUTS. Stamped with the Tinnerman "T"—the mark of total reliability. *Tinnerman Products, Inc., Department 12, Box 6688, Cleveland 1, Ohio.*

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GREAT BRITAIN: Simmonds Aerocessories Ltd., Treforest, Wales.
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TINNERMAN Speed Nuts®
Look for the Tinnerman "T"

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Bonded Rubber Pads Damp

E. J. Stefanides, Central States Editor

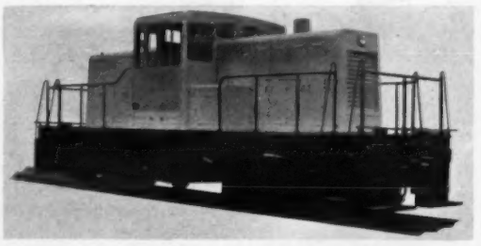
In the most recent design of a widely used type of locomotive traction motor, preloaded bonded rubber pads provide a flexible suspension for the motor nose. The resulting suspension system not only provides flexibility and motor support, but it also has been highly successful in reducing the tendency toward motor nose oscillation as tractive effort varies.

In this type of traction motor, the motor and gear reduction form an integral unit, with the gear case supported on the axle by bearings and the motor nose supported on the truck. This requires a flexible suspension between motor nose and truck to sustain the weight, permit axle movement in the journal guides and to absorb the reaction resulting from motor torque.

Coil springs and fabric washers both were tried unsuccessfully for this type of traction motor.

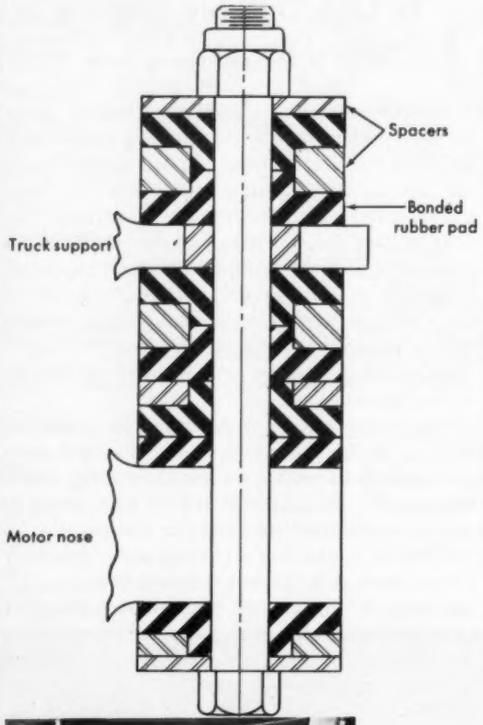
The bonded rubber pads of the present suspension system have ideal characteristics. Not only do they provide the required flexibility for axle movement, but they also have a nonlinear load curve and an inherent hysteresis effect. By assembling pads in a preloaded condition, advantage is taken of the nonlinear loading. This reduces vertical movement caused by tractive effort and subsequent inertia effects. The hysteresis effect provides damping or snubbing which eliminates serious chattering.

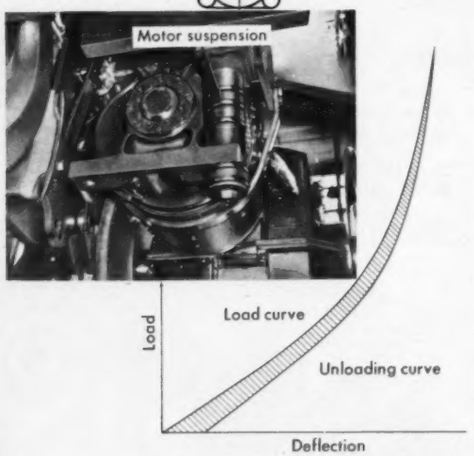
This suspension has been tested extensively in service for another three years in diesel-electric locomotives, operating in industrial and light road switching and mine haulage. It was designed by the Locomotive and Car Equipment Dept. of the General Electric Co., Erie, Pa.



INDUSTRIAL SWITCHING DIESEL-ELECTRIC LOCOMOTIVE is equipped with new traction motor nose suspension system. Vibration reduction has appreciable decreased maintenance requirements, particularly for gears, pinions and brush rigging.

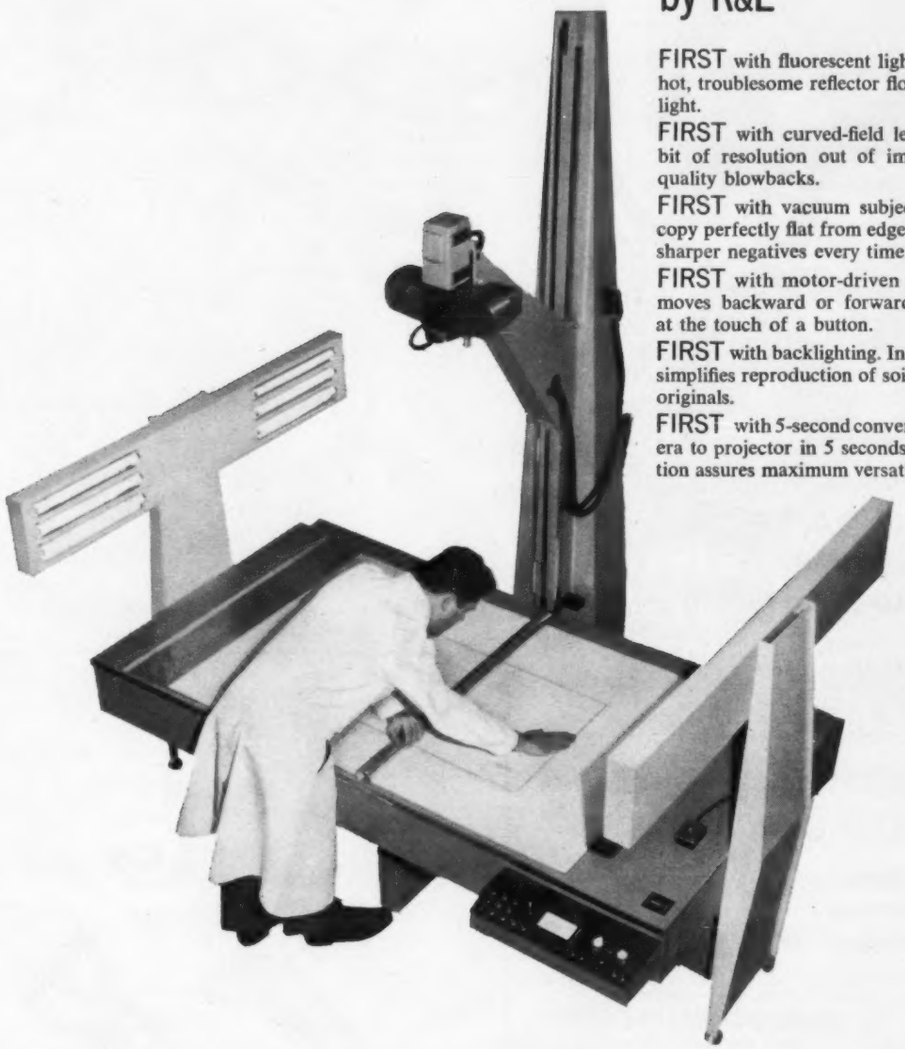
Traction Motor Oscillations





TRACTION MOTOR NOSE SUSPENSION uses bonded rubber pads. Pads are assembled under preloaded condition corresponding to reaction caused by motor torque representing 20 to 30 percent adhesion between wheels and rail. Preloading reduces amplitude of vertical movements caused by tractive effort and subsequent inertia effects. In earlier designs, motor was supported by coil springs both above and below truck bracket.

the new MICRO-MASTER® 35mm Camera-Projector by K&E



FIRST with fluorescent lighting. Eliminates hot, troublesome reflector floods, gives better light.

FIRST with curved-field lens. Assures last bit of resolution out of image for highest quality blowbacks.

FIRST with vacuum subject-holder. Holds copy perfectly flat from edge to edge, assures sharper negatives every time.

FIRST with motor-driven projector. Film moves backward or forward for projection at the touch of a button.

FIRST with backlighting. Increases contrast, simplifies reproduction of soiled or two-sided originals.

FIRST with 5-second conversion. From camera to projector in 5 seconds—simple operation assures maximum versatility and output.

A host of technical firsts and *finests* make this the most efficient 35mm unit yet perfected. Specifically tailored for *engineering* miniaturization and reproduction, the new MICRO-MASTER 35mm Camera-Projector enables greater accuracy than any other 35mm unit. The more you learn about this new unit, the more you'll want it. To get the full story, see your local K&E dealer, or fill out and mail the coupon below:

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Please send me complete descriptive literature on the new MICRO-MASTER® 35mm Camera-Projector by K&E.

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Aluminum Fingers Pivot To Latch Cryogenic Coupling

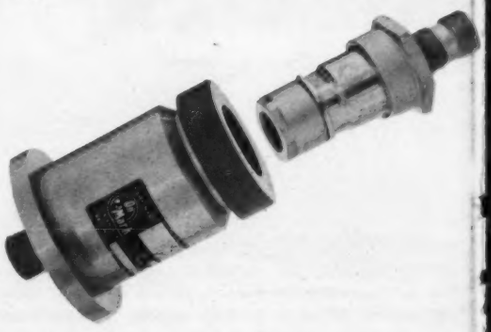
Edward W. Schrader, Western Editor

Thirteen individual aluminum fingers pivot within a socket to latch on a mating groove in a quick-disconnect coupling. The aluminum fingers are made of 6062-T6 aluminum alloy. They have a hard anodized finish for wear resistance.

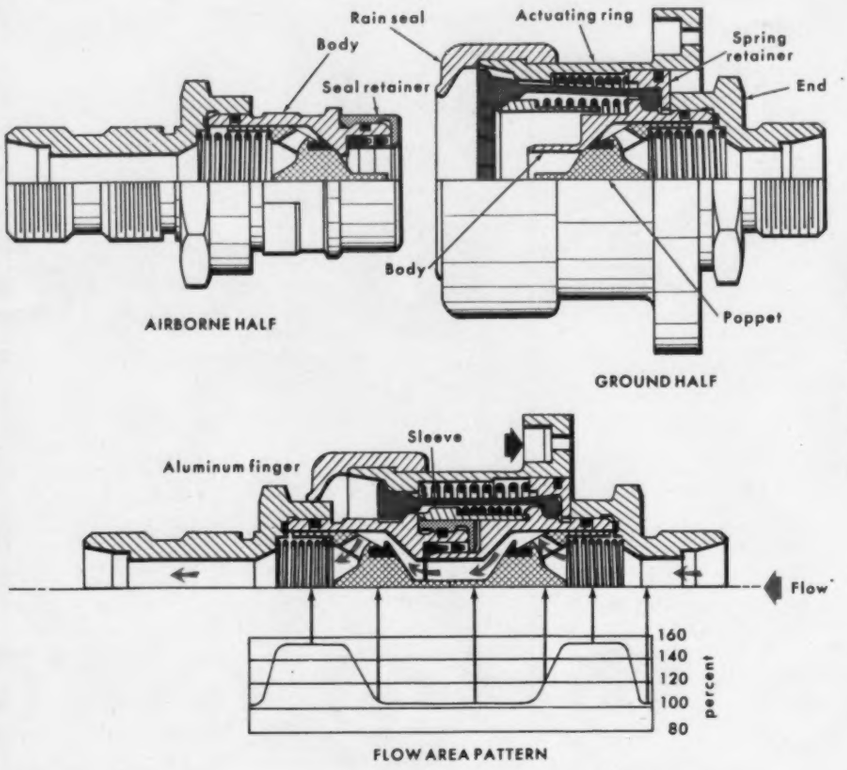
In mating the two halves of the coupling, the nose of the airborne portion impinges on a spring-loaded sleeve in the ground portion. As the sleeve retracts, a spring-loaded actuating ring extends over the fingers to close on and lock the fingers into a latching groove on the body of the airborne portion.

Simultaneously, the noses of the two poppet assemblies in both portions of the coupling cause the poppets to retract against their compression springs. The poppets with molded seals unseat to permit streamlined flow through the coupling.

Quick disconnection is effected either manually or by means of a lanyard attached to the actuating ring on the ground portion. Retraction of the ring against its compression spring frees the aluminum fingers to pivot radially outward, thus releasing them from their latched position in the groove of the airborne portion. Simultaneously, a compression spring extends the sleeve of the ground portion to assist in imparting the pivoting motion to the fingers. As the two pieces separate, the spring-loaded poppets extend to seal against leakage. Fluid pressure behind the poppets assist in making the seal. The quick-disconnect coupling for cryogenic use is a design development of On Mark Couplings, Los Angeles, Calif.



QUICK-DISCONNECT COUPLING is rated for operating pressure to 3000 psi. It is designed for helium gas over operating temperature range of −320 to 200F.



SECTION VIEW OF QUICK-DISCONNECT COUPLING shows fingers latched on airborne portion. Flow area pattern demonstrates means of keeping pressure drop to a minimum.

CONTROL

New! Space savingest relay you've ever seen: New Cutler-Hammer "Compact 300"

Cutler-Hammer's new, versatile 300 volt 6 amp., industrial control relay is so reliable it's permanently sealed. Bifurcated contacts add even more millions of operations.

So compact you can get 8 circuits in a panel space only 2" wide by 2¾" high. 2, 3, 4, 6, 8 poles with any combination of N.O. or N.C. contacts available. Add new "mechanical memory" latch at any time. Same life as relay. Get full details in PUB. L079-H272.

WHAT'S NEW? ASK...

CUTLER-HAMMER

Cutler-Hammer Inc., Milwaukee, Wisconsin • Division: Airborne Instruments Laboratory • Subsidiary: Cutler-Hammer International, C. A. Associates: Canadian Cutler-Hammer, Ltd.; Cutler-Hammer Mexicana, S. A.

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NEW

SNAP ACTION

FEATHER TOUCH SWITCH

with QUICK CONNECT TERMINALS

- Feather-touch operating torque (4 inch grams maximum)
- Accepts standard .205 x .032 Q.C. terminals
- Can be used for solder connection also
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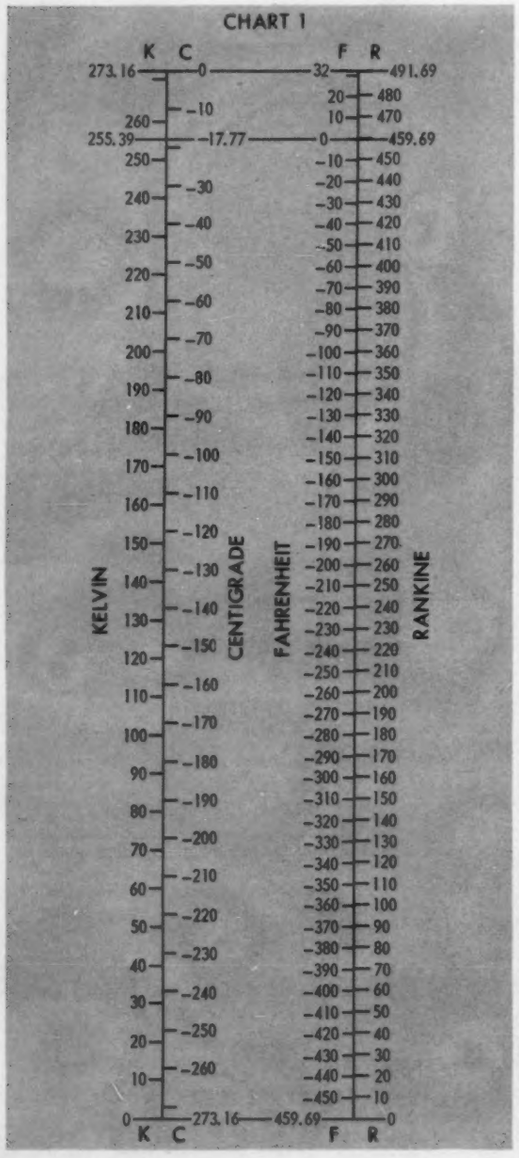
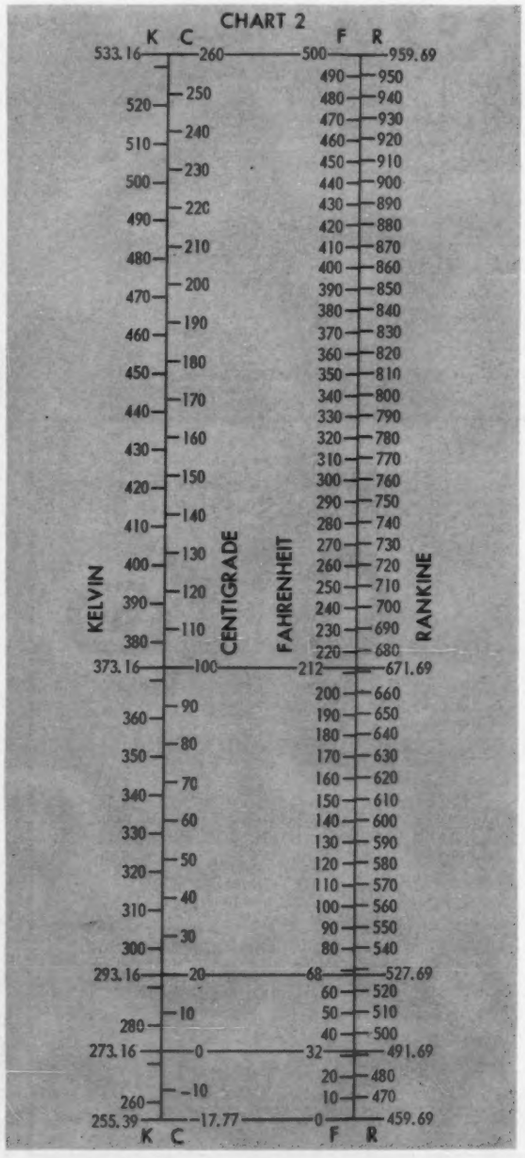
DESIGN DATA NEWS

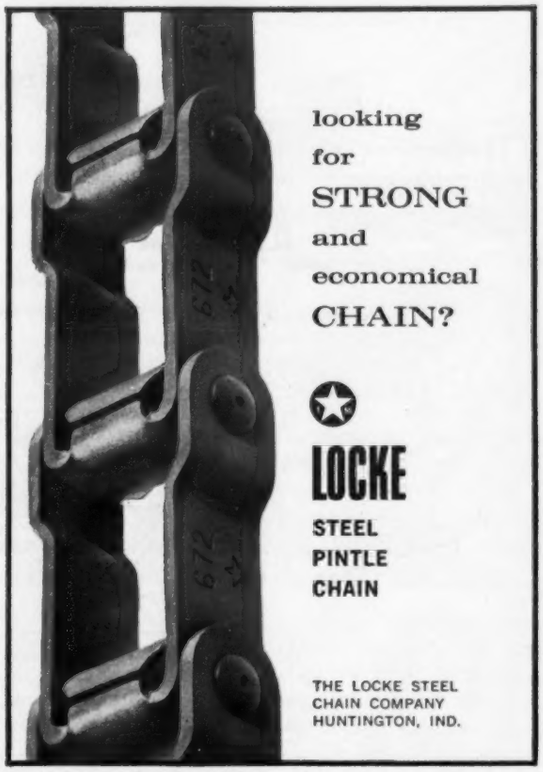
Temperature-Scale Reference Charts

The following charts will be useful in determining approximate temperatures in Fahrenheit and Centigrade (or Celsius) and their respective absolute scales.

Charts 1 through 4 cover a range from absolute zero to 1500F. Chart 5 expands a portion of Chart 2 and covers from zero to 212F. Chart 6 covers from absolute zero through 4500F.







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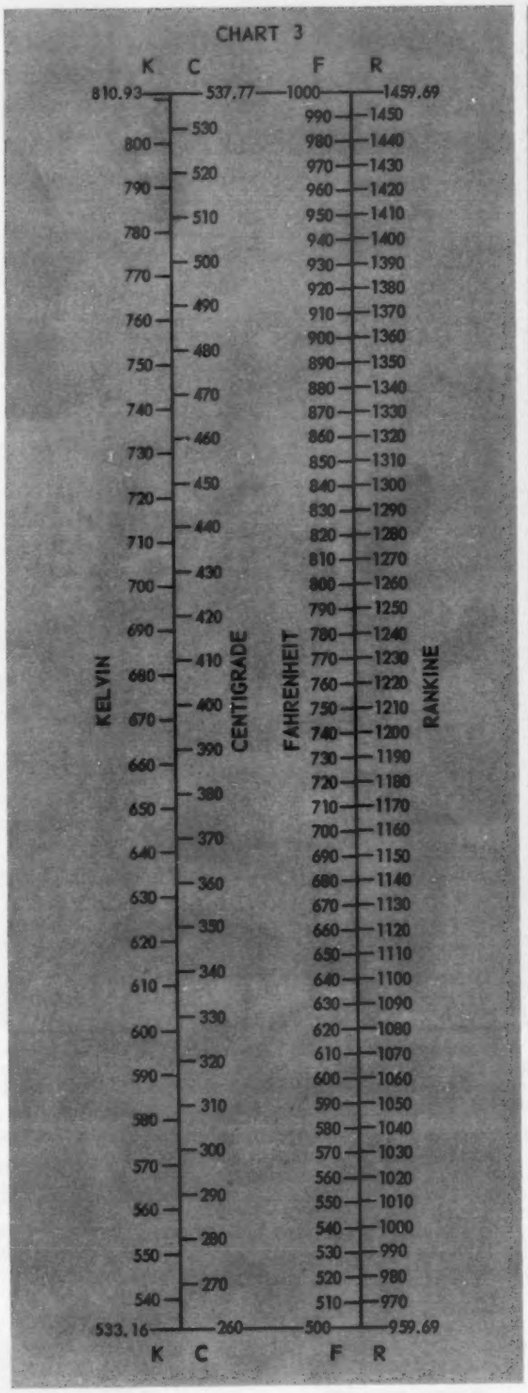


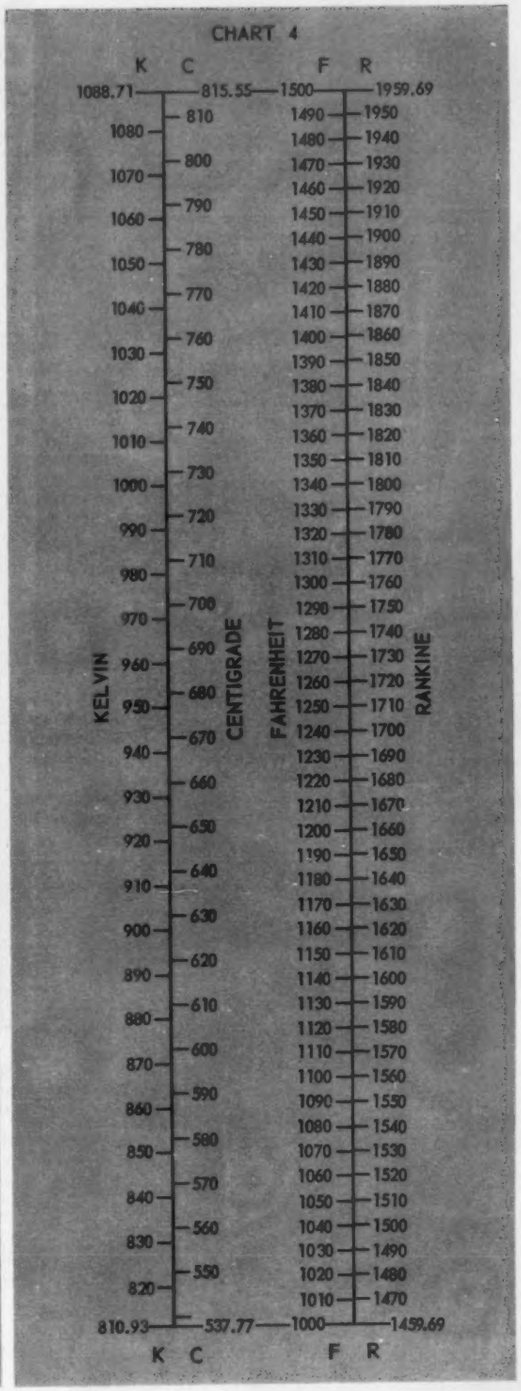
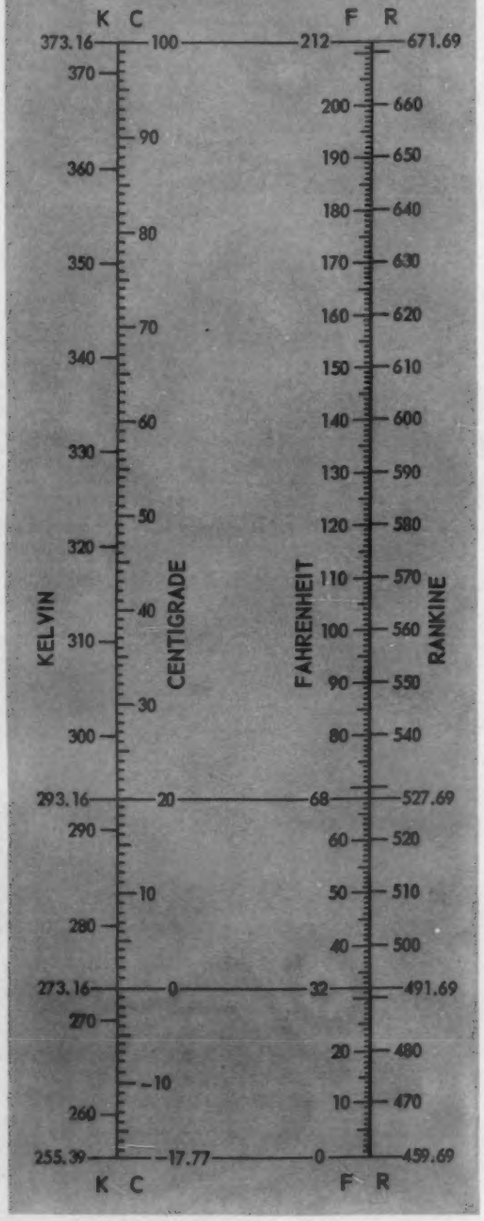
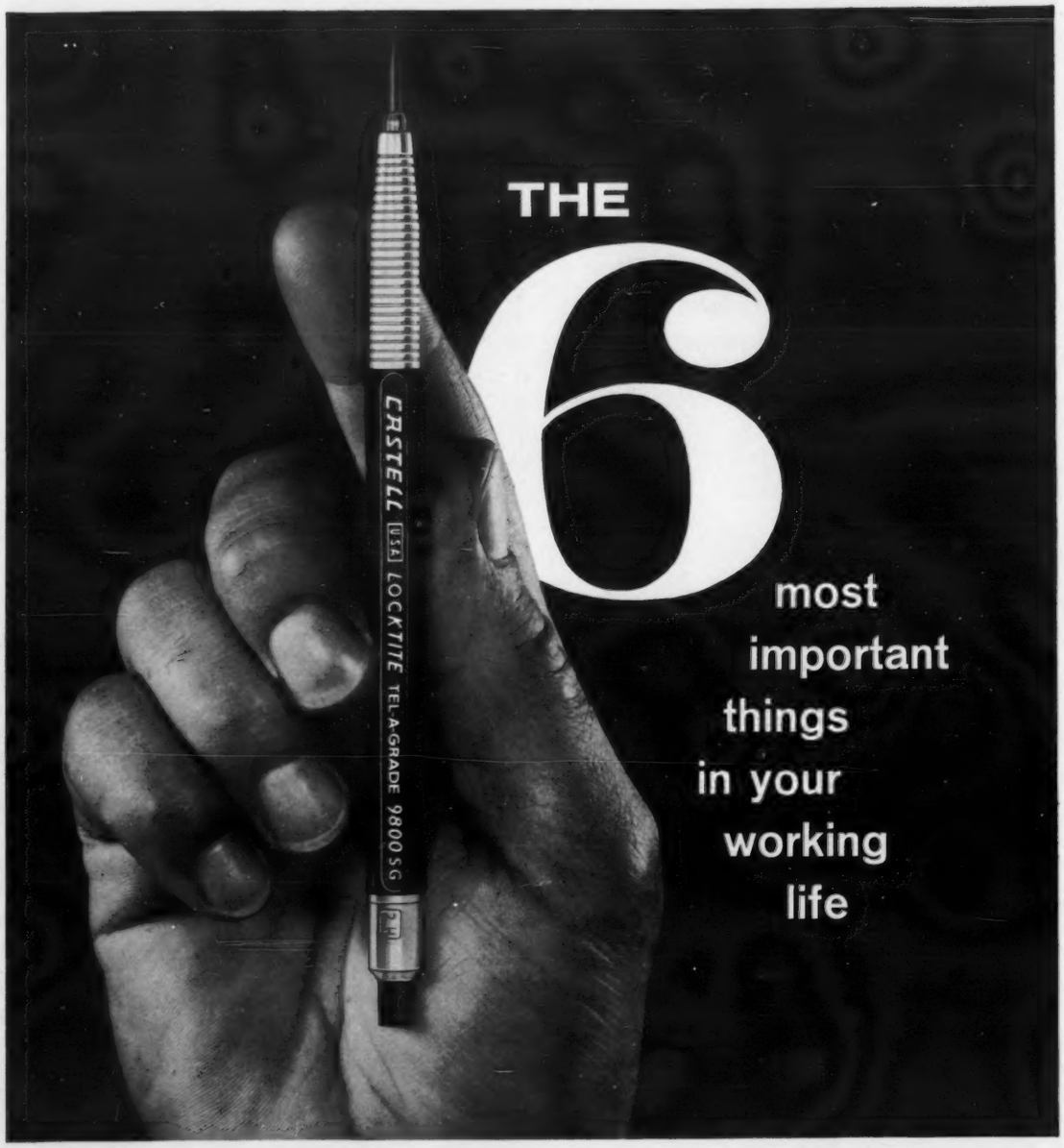


CHART 5





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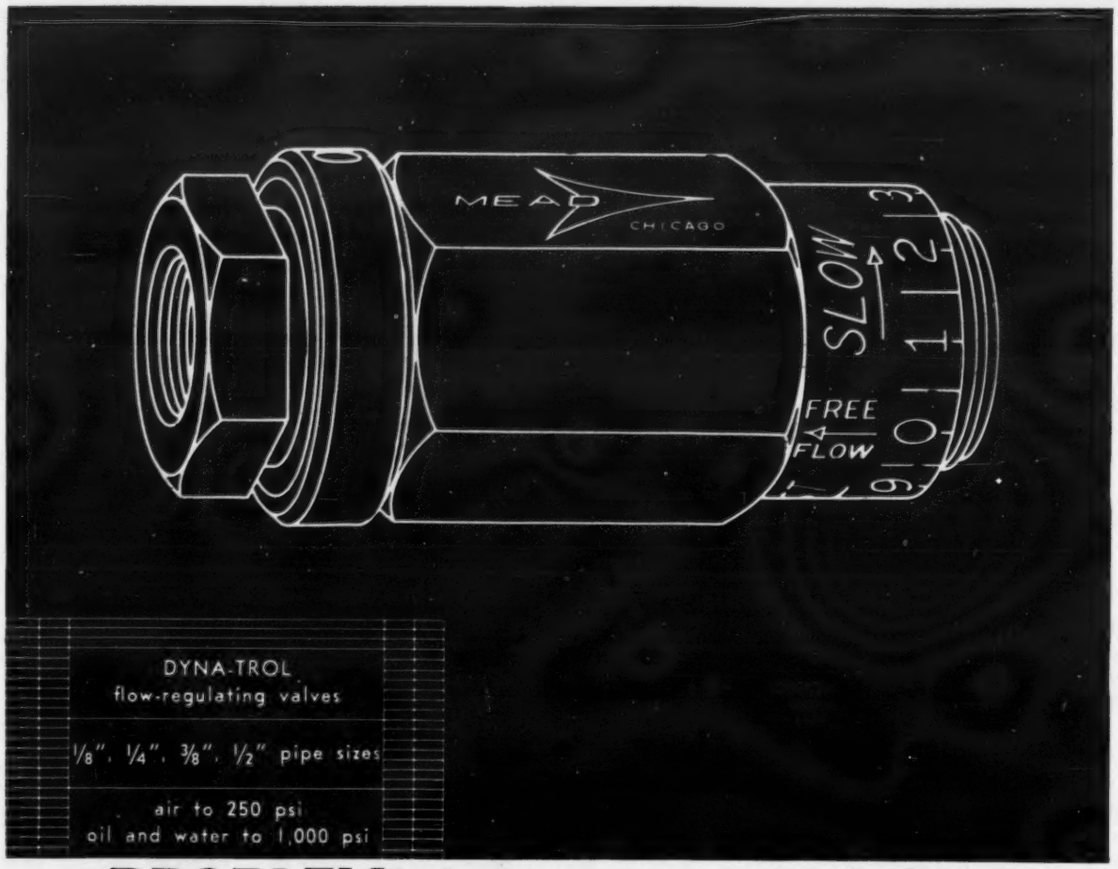
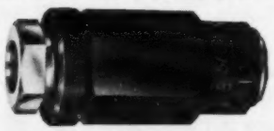


PROBLEM: how to replace a 1/4" valve with a less-costly 1/8" valve (and get extra precision in low-flow ranges)

SOLUTION: NEW MEAD DYNA-TROL VALVE



Check these design advantages of the new MEAD DYNA-TROL flow-regulating valve:

- Adjusting sleeve — easily rotated by hand — locks to any setting and cannot be accidentally removed from valve body
- Calibrated sleeve records settings for future reference
- Knife-edge variable orifice reduces flow distortion caused by viscosity changes in working medium
- No internal springs to cause malfunction
- All parts rust-proof
- Wide operating range: −40° F. to +250° F.

Small, economical MEAD DYNA-TROL flow-regulating valves can replace more costly valves of larger pipe size. Reason: Internal design permits pneumatic or hydraulic flow equal to full pipe area in both directions. The first 360° turn of the adjusting sleeve increases flow from zero to about 10% of potential — a new measure of precision in low-flow ranges. Successive turns accurately reach 100% of pipe capacity. To cut costs and give exacting control to piston speeds, specify MEAD DYNA-TROL valves to solve your flow regulating problems. For information on quick delivery, write to MEAD *today*.

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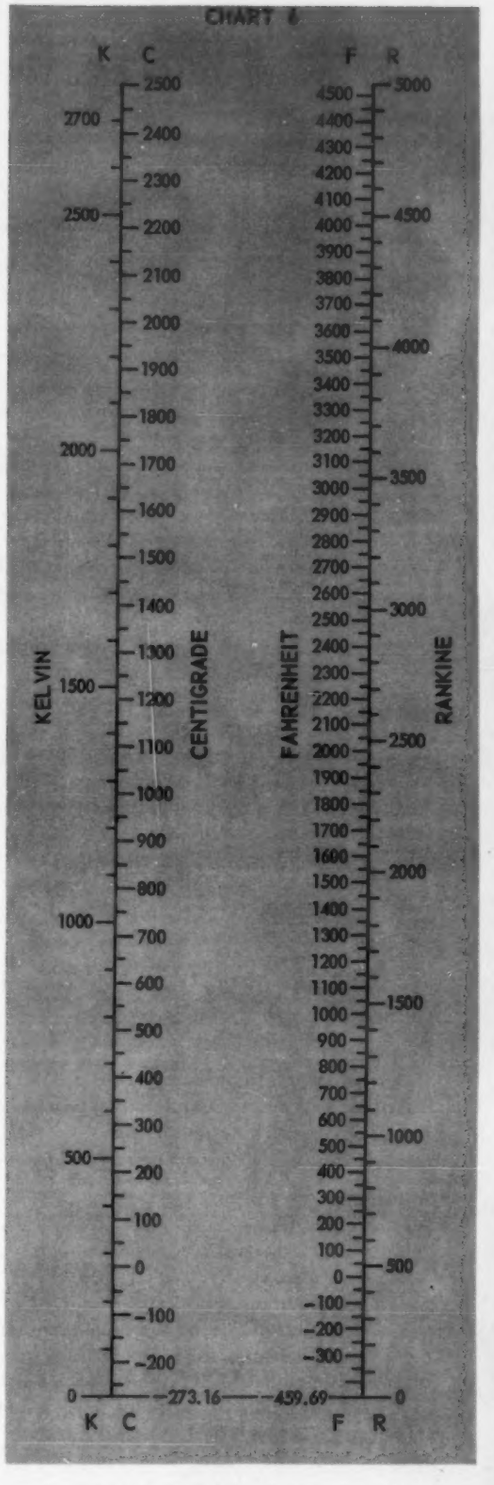

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Nomogram For Basic Gas Equations

G. Szilva, Mechanical Engineer,
Climax Molybdenum Co., Coldwater, Mich.

The following equations are common in work involving thermodynamics:

(1) $pv^n = \text{constant}$ or $p_1v_1^n = p_2v_2^n$

(2) $Tv^{n-1} = \text{constant}$ or $T_1v_1^{n-1} = T_2v_2^{n-1}$

(3) $Tp^{(1-n)/n} = \text{constant}$ or $T_1p_1^{(1-n)/n} = T_2p_2^{(1-n)/n}$

Where:

p = absolute pressure (p_1 and p_2 must have same units)

v = volume or specific volume (v_1 and v_2 must have same units)

T = absolute temperature (T_1 and T_2 must have same units)

They are valid in many cases where the medium can be considered an ideal gas. The nomogram may be used for:

(1) Reversible adiabatic process where "n" is called "k", the adiabatic exponent.

(2) Irreversible adiabatic process if "n" can be assumed constant.

(3) Reversible isothermal process where "n" = 1.

(4) Irreversible isothermal process (throttling) where "n" = 1.

(5) Reversible polytropic process if "n" can be assumed constant.

(6) Irreversible polytropic process if "n" can be assumed constant.

The general mathematical form used in the nomogram is $a_1b_1^x = a_2b_2^x$ and can be used for all three equations.

Example:

Determine the final temperature of air if it is compressed to 20 cu ft and if the process is assumed adiabatic. The temperature was 40F and the volume was 200 cu ft before compression.

Solution:

$a_1 = T_1 = 460 + 40 = 500R$

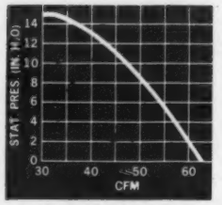
$b_1 = v_1 = 200$ cu ft

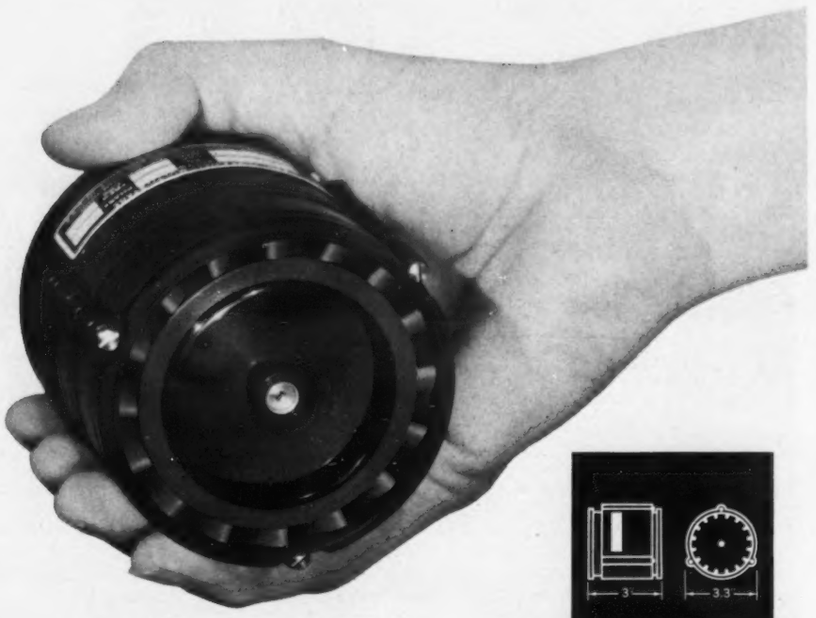
$b_2 = v_2 = 20$ cu ft

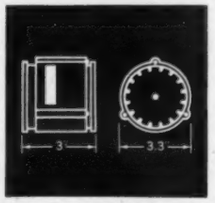
The exponent $x = n\text{-}1 = k\text{-}1 = 1.4\text{-}1 = 0.4$

To keep the solution on the nomogram, factor $a_1 = 500$ by 100 and use $a_1 = 5$. Final reading must be multiplied by 100 to get correct answer.

Align $b_1 = 200$ with $x = 0.4$, and extend to intersect Reference line 1. Align this intersection with $a_1 = 5$, intersecting Reference line 2.







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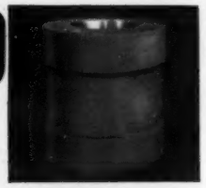

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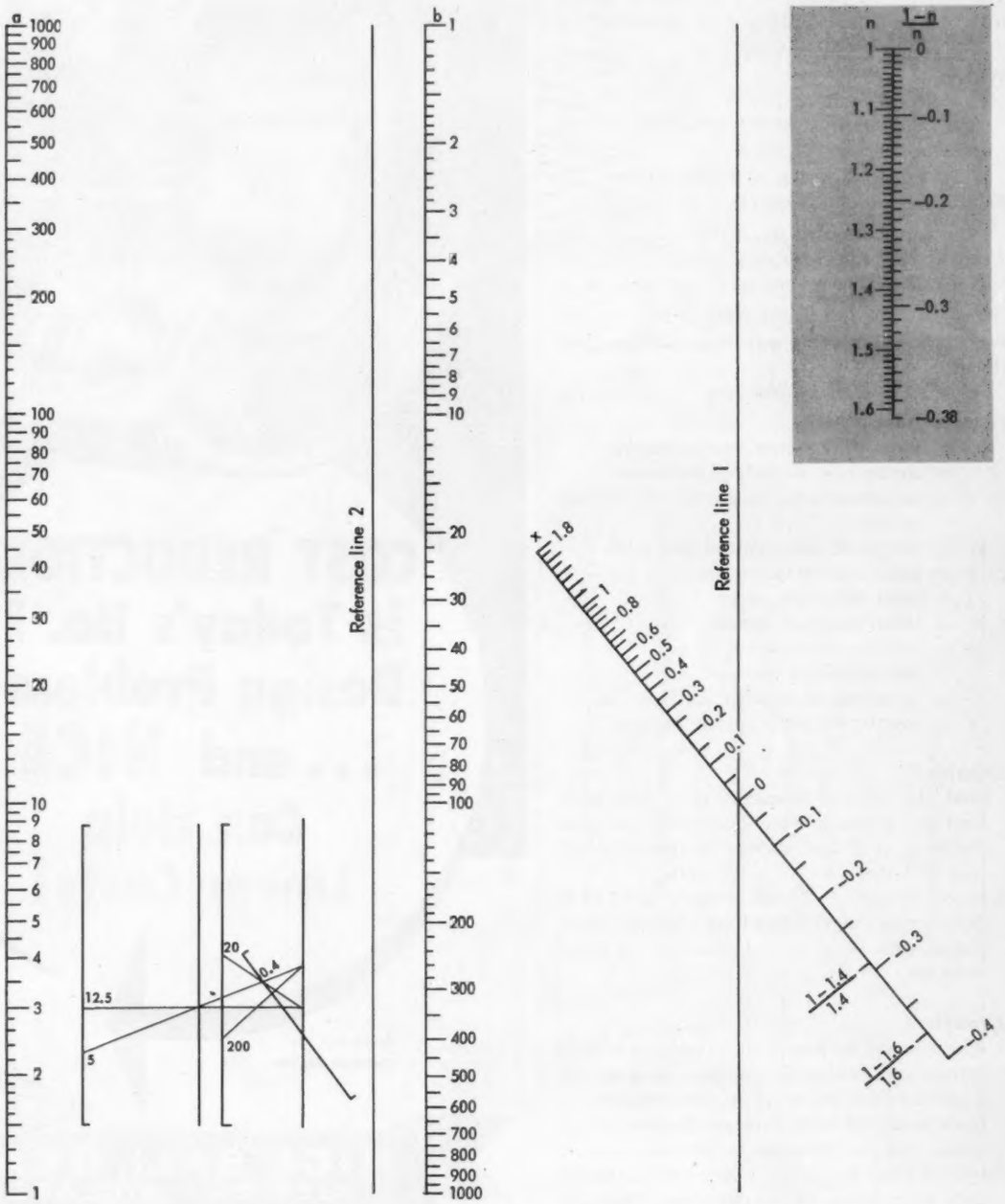
Align $b_2 = 20$ with $x = 0.4$ and extend to Reference line 1. Align this intersection with intersection on Reference line 2, and extend to read $a_2 = 12.5$.

$\therefore\ T_2 = (12.5)\ (100) = 1250R$, and

$t_2 = 1250 - 460 = 790F$.



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Natural Frequency Of Cylindrical Springs

Richard Wadler, Mechanical Engineer,
Raytheon Co., Bedford, Mass.

The natural frequency of a cylindrical spring with one end clamped (Fig. 1) is given by:*

$$f = 1/2\pi \sqrt{2F_o g/W} \quad (1)$$

Where:

F_o = spring rate = F/y (2)

y = deflection = $8FD^3N/d^4G$, and (3)

therefore: $F_o = d^4G/8D^3N$ (4)

W = weight of spring = $0.785d^2\pi DNw$ (5)

Substituting (4) and (5) in (1)

$$f \cong d/ND^2 \sqrt{G/w} \quad (6)$$

Using average values for steel in (6):

G = 12,000,000 psi and w = 0.28 lb/cu in:

$$f \cong 6500d/ND^2 \quad (7)$$

For a cylindrical spring with both ends clamped (Fig. 2):

$$f \cong 13{,}000d/ND^2 \quad (8)$$

Nomenclature:

- f = natural frequency, vibrations/sec
- F_o = spring rate, lb/inch of deflection
- g = acceleration due to gravity, 386 inches/sec/sec
- W = weight of active part of spring, lb
- F = axial load on spring, lb
- y = axial deflection, inches
- D = mean diameter, inches
- N = number of active coils
- d = wire diameter, inches
- G = transverse modulus of elasticity, psi
- w = specific weight of spring, lb/cu in

Example 1:

Find the natural frequency of a cylindrical steel spring with one end clamped if the mean diameter is 2 inches, wire diameter is 0.3 inch and there are 10 active coils.

Solution: Align D = 2 inches with d_1 = 0.3 inch, intersecting the reference line. Align this intersection with N = 10 and read f = 49 vibrations/sec.

Example 2:

The natural frequency of a cylindrical steel spring, with both ends clamped, must not exceed 21 vibrations/sec. Find the required active number of coils if mean diameter is 1⅞ inches and wire diameter is 0.05 inch.

Solution: Align D = 1.875 inches with d_2 = 0.05 inch, intersecting the reference line. Align this

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intersection with f = 21 vibrations/sec and read N = 9 coils.

*References:
1. "Machine Design", V. L. Maleev and J. B. Hartman.
2. Kent's "Mechanical Engineer's Handbook".

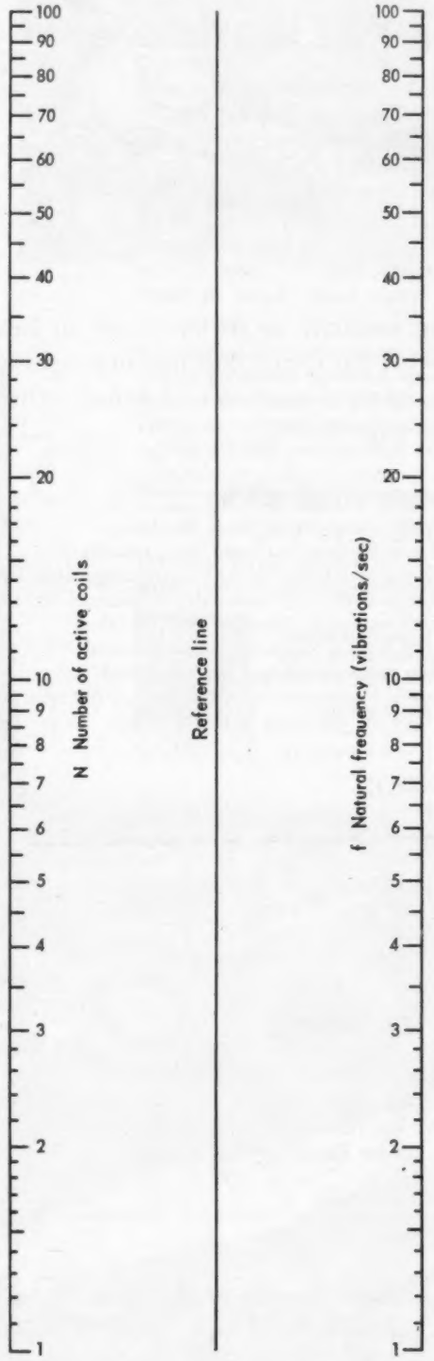
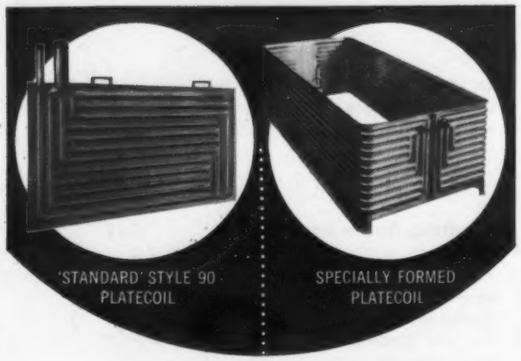

N Number of active coils
Reference line
f Natural frequency (vibrations/sec)
d1 Wire diameter (one end clamped) (inches)
d2 Wire diameter (both ends clamped) (inches)
D Mean diameter (inches)
EXAMPLE 1
EXAMPLE 2

Fig. 1

Fig. 2



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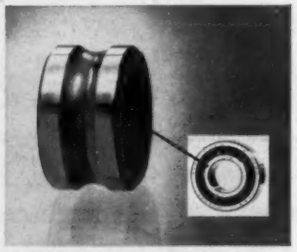
A NEW PRODUCT DEVELOPMENT FROM BARDEN

PERFORMING WELL IN A HOT SPOT

As every parent knows, small boys have an amazing capacity to perform well in heat that would fell the average adult. In much the same way, BarTemp* ball bearings operate effectively up to 575° F., permitting synchros, fans, control motors and other lightly loaded devices to perform at higher temperatures than ever before. *TRADE MARK



▲ Unretouched photo of inner ring from BarTemp bearing that ran 2727 hours—1010 hours at 500°F. plus an additional 1717 hours at 575°F. Dark band in raceway is lubricant transferred from retainer.
▼ Excerpts from lab and field test results.

Bearing	Temperature	Speed (RPM)	Hours
SR3HX110	500°F. 575°F.	1,200	2727
SR4HX110	338°F.	10,000	2500+
SR3HX110	392°F.	1,200	1240+
SR3BSSX112	500°F.	4,500	1036+
SR2HX110	575°F.	2,500	1628

NEW DESIGN DEVELOPMENTS
Two design innovations made BarTemp possible—a Barden-developed heat treatment for stainless steel used for the bearing rings, and a new retainer that serves as a dry lubricant and a ball separator. The BarTemp retainer, reinforced Teflon compounded with a solid lubricant, is the sole lubrication required. As the bearing rotates, the balls transfer microscopic particles of the lubricant to the raceways.

TEST RESULTS
In tests by more than 20 precision bearing users, BarTemp bearings in synchros, control motors, blowers, pressure switches, tachometer generators and other lightly loaded devices have operated from 1000 to 24,000 RPM and at temperatures from —100°F. to 575°F. Typical life exceeds 1,000 hours.

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Prototype quantities of seven BarTemp sizes from .3125" to .7874" O.D. are immediately available in angular contact types, open or shielded. For further data and detailed test results, ask for BarTemp Data Sheet B-1.

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LITERATURE

To obtain copies of numbered literature . . . circle appropriate number on Reader-Service card.

Drafting Room Equipment 451

Equipment advances in the engineering field designed to reduce fatigue, increase individual draftsman efficiency and save floor space. Product and planning guide ADR-612 contains 32 pages illustrating drafting and tracing tables, filing equipment and drafting accessories. Specification charts are provided as well as suggestions and ideas for planning the file area. Hamilton Mfg. Co., Two Rivers, Wis.

Clamps, Fixture Components 452

Catalog No. 1110 covers a complete line of clamps and fixture components and provides a special section on toggle-action clamps. Tables of specifications for these components, with a special accessories and replacement-parts chart for toggle-action clamps, complete the 52-page catalog. Universal Engineering Sales Co., Frankenmuth, Mich.

Electronic Catalog 453

Complete price and performance information on a comprehensive variety of electronic equipment and components and radio-TV supplies. This 268-page catalog is indexed by products, new products and manufacturers, and includes a tube cross-reference. Wedemeyer Electronic Supply Co. of Michigan, Ann Arbor, Mich.

Materials Technology 454

A handy, data-packed, eight-page roundup on 12 new products. The materials described offer important opportunities for improved design and performance in applications requiring resistance to abrasion, chemicals, corrosion, nuclear radiation and high temperatures. Carborundum Co., Dept. BMD, P. O. Box 337, Niagara Falls, N. Y.

Properties and Selection Of Metals 455

A 32-page illustrated brochure describes the new, 1300-page ASM Metals Handbook, 8th Edition, Vol. 1. Actual examples from each of six major sections are presented with documentary information on how the book was compiled by 1335 ASM members from every area of industry. American Society for Metals, Metals Park (Novelty), Ohio.

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DIAMOND

cracks DESIGN BARRIERS

New horsepower ratings* for DIAMOND Roller Chains, plus four new products, have opened up a whole new range of DIAMOND Roller Chain applications for design engineers!

Size for size, DIAMOND now gives you increased horsepower capacity, higher speeds, longer life, and greater economy in present applications . . . and suggests many new areas in which roller chain efficiency can be utilized.

Example: *Former* ratings for 1″ pitch roller chains permitted sprocket speeds up to 1160 RPM; *new* ratings include speeds to 2800 RPM. Rated horsepower capacities formerly did not exceed 49 HP; *new* ratings exceed 150 HP.*

*New speed and horsepower ratings are those established by the Association of Roller and Silent Chain manufacturers, of which DIAMOND is a charter member.

See next page for DIAMOND's four new product developments which may help you solve present special problems.

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DIAMOND CHAIN COMPANY, INC.
A Subsidiary of American Steel Foundries
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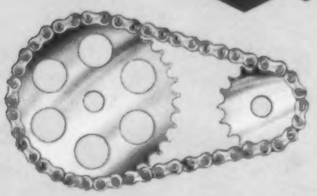
DIAMOND Micropitch® ROLLER CHAIN



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Tensile Strength:
180 Lbs.

For cameras, computers, recorders and other devices with miniaturized movements requiring strength, synchronization, and precision. Precision built of corrosion resistant, non-magnetic stainless steel. Stock sprockets available . . . or made to your specifications. Conveyor chain supplied with special attachments on custom orders.

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® REGISTERED IN UNITED STATES PATENT OFFICE

These new products can help solve your design problems

DIAMOND hi-Cap™ FLEXIBLE COUPLINGS

Shaft-rated for selection by shaft diameters!

Hi-Cap Couplings give you

- Lower Cost
- Bearing and Shaft Protection
- High Torque Capacity

Hi-Cap means High Capacity

All working parts are heat treated steel, hardened to give greater resistance to wear and longer service life. Hi-Cap Couplings can be quickly installed, aligned and connected without special tools. A single pin easily connects the coupling chain. Removal of chain completely disengages the driving and driven units. Available in Finished Bore and Taper Lock.

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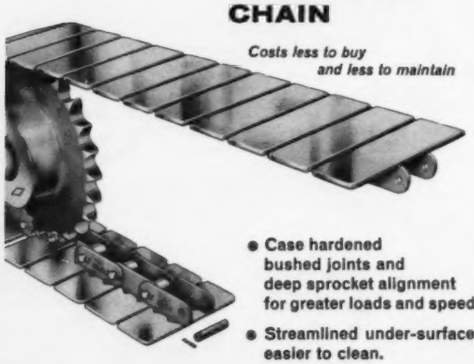
DIAMOND durawelds TOP PLATE CONVEYOR CHAIN

Costs less to buy and less to maintain



- Case hardened bushed joints and deep sprocket alignment for greater loads and speeds
- Streamlined under-surface is easier to clean.

DIAMOND "Projection welds" produce a permanent metal fusion as strong as the metal itself. *Duraweld* eliminates rivets, attachments and extra fittings. *Duraweld* is easily detachable at any joint. Links are interchangeable with links of other roller chains of the same general type and may be used on existing rails.

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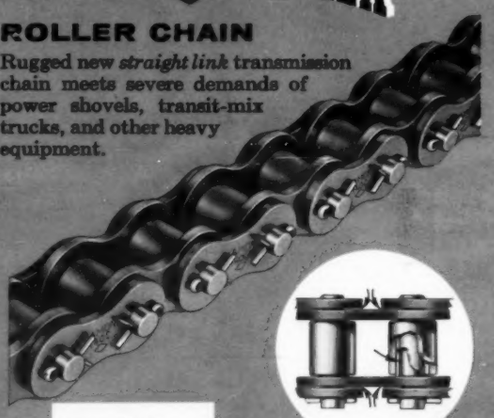
DIAMOND TUF-FLEX™ ROLLER CHAIN

Rugged new *straight link* transmission chain meets severe demands of power shovels, transit-mix trucks, and other heavy equipment.



Extra clearance between inside and outside linkplates and between pins and bushings permit extra flexibility and reduces stiffness.

Each 4' of TUF-FLEX Chain provides up to 4" lateral displacement from center line and up to 8° twist to accommodate sprocket misalignment.

Proven advantages: Longer service life, greater capacity for shock and peak loads. Easier chain connection; may be used over existing sprockets cut for American standard roller chains of same pitch, or equivalent offset side bar chains.

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DIAMOND CHAIN COMPANY, INC.

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Electronic-Electrical Facilities 456

Design, engineering and manufacturing facilities for aviation, missiles, space vehicles, automation controls, industrial, municipal, public utilities, transportation and marine. Illustrations are provided of plant operations and standard products in electronic, electrical, military and commercial industries. The 16-page brochure, "Yesterday, Today, Tomorrow", shows in diagram-form company management and integrated operations. Kurz & Root Co., Appleton, Wis.

Torque-Tension Manual 457

An 18-page Design Manual, No. 6101, includes 12 tables listing specific recommended installation torque values for thin and standard height UNC and UNF hex-type nuts. It discusses factors to be considered in selecting a tightening torque, also effects of the use of lubricants. Additional data include tables of tensile stress areas and bolt strengths. Elastic Stop Nut Corp. of America, 2330 Vauxhall Rd., Union, N. J.

Precision Metalworking Equipment 458

Detailed information and costs on precision metalworking equipment. Catalog No. 61 covers hand- and power-operated precision metalworking machines, related accessories and expendables including single-station punches and dies, adjustable punches and dies and standard V-type press brake dies. The 32-page catalog also provides a selector guide and index. Di-Acro Corp., 10 Jefferson Ave., Lake City, Minn.

Thermocouples, Pressure Probes 459

Complete specifications, details and prices on thermocouples, pressure probes and allied components. This 60-page catalog offers an off-the-shelf line of industrial thermocouples and pressure probes, manufactured with aircraft quality. A "simple-to-order" format makes this catalog an easy buying reference. Advanced Dynamics Inc., 16321 Rockside Rd., Cleveland 37, Ohio.

Self-Locking Fastener 460

Reviews a self-locking swage nut, half the weight of comparable fasteners and designed for fast, economical installation in thin metals, including dimensional data for the single installation tool. Performance data include size-by-size tabulation of minimum tensile strengths in pounds for both coarse and fine threads. Standard Pressed Steel Co., Jenkintown, Pa.

Size 5 Servomotor Data 461

Shows photos of size 5 unit, outline and schematic drawings and torque-speed curves. Other data include complete electrical and mechanical specifications, motor dynamics, construction features and modifications available. Helipot Div. of Beckman Instruments, Inc., 2500 Fullerton Rd., Fullerton, Calif.

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New

ROTO MISSION®

Most versatile transmission ever developed!

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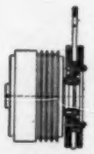
With these standard accessory features

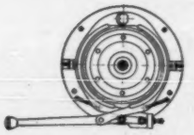
SPRING REACTION ARM

Incorporates a series of leaf springs which provide progressive overload capacity, reduce shock loading, and prevent internal damage to the unit.



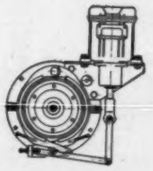
FRICTION REACTION ARM

A spring-loaded friction clutch combined with the reaction arm assembly. Designed to slip at a preselected torsional overload. Restores normal operation automatically when overload ceases.



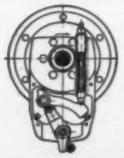
MANUAL FRICTION CLUTCH

Permits manual engagement and disengagement of the unit. Provision is made for adjusting the clutching pressure as well as compensating for wear.



ELECTROMAGNETIC CLUTCH

This modification of the manual friction clutch provides remote control of the unit by means of solenoid actuation.

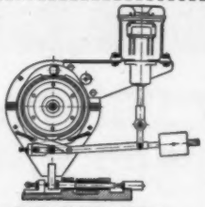


TORQUE RELEASE ASSEMBLY TYPE "A"

A mechanical attachment—integral with reaction arm—which provides complete disengagement when a preselected torque is exceeded.

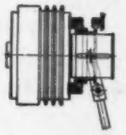
TORQUE RELEASE ASSEMBLY TYPE "B"

A mechanical attachment—separately mounted—which provides complete disengagement when a preselected torque is exceeded.



TORQUE LIMITING CLUTCH

Mechanical modification of the electromagnetic clutch assembly to provide automatic disengagement when a preselected load is exceeded.



DIRECT MESH ATTACHMENT

Permits 2-speed operation through a manually operated clutch mounted on reaction hub.

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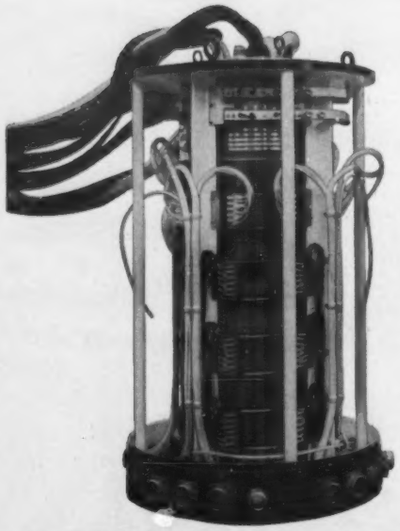


SEND FOR A COPY OF 28-PAGE CATALOG 66SR WHICH PROVIDES OPERATING DATA ON BREEZE CUSTOM UNITS AND DRAWINGS AND SPECIFICATIONS OF ALL STANDARD SLIP RING ASSEMBLIES.

COMBINING CUSTOM AND STANDARD SLIP RING ASSEMBLIES

FOR LOWER COSTS—FASTER DELIVERY

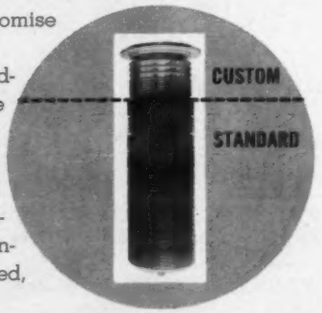
This slip ring assembly controls, powers and monitors the centrifuge arm of a motion simulator. Its production required the combination of highly creative engineering skills, well-equipped manufacturing facilities and diversified production methods available to you at Breeze.

The unit, having a duty cycle of 2000 amps, is only 48" high, yet contains 425 slip rings. These include both standard rings and rings engineered for this application. There are rings of flat and cylindrical design, electroplated rings and rings of fabricated construction in the assembly.

Whatever your slip ring requirement, it can be met without compromise at Breeze.

For general applications, Breeze offers a line of field-proven standards with ring envelope diameters from 1" through 10½". These are flat, fabricated assemblies built from off-the-shelf components to insure rapid delivery at reduced costs.

For custom applications including general purpose control and power, radio frequency and video, high voltage, high speed instrumentation and switching, Breeze produces flat, cylindrical or concentric assemblies using all standard construction methods, fabricated, electroplated and plastic molded.



BREEZE MARK

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Manufacturers of electrical, electro-mechanical and hydro-mechanical components and systems and fabricated metal products.

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LITERATURE

Magnetic Shield Data 462

Reference data on magnetic shields and shielding materials and a catalog of shaft hardware. The 16-page booklet contains curves and tables to help the design engineer select the proper shield for his particular application. Included are "Nicoloi" and "Mu-Metal" shields for multiplier phototubes, charge storage tubes and cathode-ray tubes, with a cross-index of tube type and required shield. The catalog section describes bezels for cathode-ray tubes, gear drives, shaft locks, bearings, couplings, knobs, dials and dial locks. James Millen Mfg. Co., Inc., 150 Exchange St., Malden 48, Mass.

Grooved Pins and Studs 463

Various types, dimensions and fastening applications of solid grooved pins and grooved drive studs. Engineering data are consolidated for fast and easy reference in this 12-page catalog, permitting engineers and designers to design the pins into assemblies without having to request further details. The catalog describes materials used, drilled-hole tolerances, shear strength, maximum torque, insertion forces, horsepower transmitted as well as the basic principle of grooved pins. Groov-Pin Corp., 1125 Hendricks Causeway, Ridgefield, N. J.

Electrical Insulations 464

This 12-page condensed book covers a complete line of electrical pressure-sensitive tapes, electrical insulating materials and silicone rubber. Construction, electrical properties, strengths, methods of application and government specification qualification of these products are presented in concise, easy-to-read form. Permacel, New Brunswick, N. J.

Industrial Pressure Clamps 465

Form B-5 gives illustrations descriptions, specifications, shipping weights and list prices of a complete line of industrial pressure clamps, hose fittings and allied products. A complete listing of the products with BS-21 (British Standard Pipe Threads), as well as NPT (American National Taper Pipe Threads) completes the 24-page catalog. Band-It Co., 4779 Dahlia St., Denver 16, Colo.

Limit Switches 466

Includes an application guide, a short section on limit switch terminology, and selection and installation guides. Bulletin GEA-7312, 12 pages, describes limit switches for automatic pilot control. Literature covers typical applications of lever, leverless and rotating cam and limit switches, as well as tripping forces involved for activation of each switch. Photo of each model is shown along with cutaway photo and callouts. Diagrams give typical dimensions of each model. General Electric Co., Schenectady 5, N. Y.

Precision Gears 467

Data on 28 types of gears and related parts. The four-page folder includes flat, hubless (with or without lighting holes), pin hub (solid or inserted), clamp hub (solid or inserted), integral clamp hub (solid or inserted), antibacklash (pin hub or clamp hub), antibacklash (integral clamp), helical, internal, miter or bevel, nonmetallic, clusters, sectors, splines and shaft gears. Applications ranging from missiles, computers, airborne devices and radar to electronics, fire control and automation are discussed. Instru-Lec Corp., 520 Homestead Ave., Mount Vernon, N. Y.

Liquid Springs 468

Standard liquid compressible spring shocks for storing and absorbing from 10 to 1,000,000 lb energy and 460,000 ft-lb energy absorption. Also included are springs, dashpots, time-delay shocks, pipe systems, actuators and accelerators. Handbook CH-1 illustrates and explains liquid compressible devices, provides design data for "specials" and pictures engineering and manufacturing facilities. Taylor Devices, Inc., 200 Michigan Ave., North Tonawanda, N. Y.

Numerical Control Capability 469

A 28-page report on numerical control and its application in the aircraft industry. The history and advantages of numerical control, equipment and operation at the machine, and methods of preparing the tapes are described for the company's installation. Schematics, proposed applications and examples of cost savings complete the report. Republic Aviation Corp., Farmingdale, Long Island, N. Y.

Precision Switches 470

A selection of products from a complete line of precision switches for industrial, commercial, data processing, airborne and electronic applications. Catalog 104, 20 pages, has photos and condensed descriptions of more than 200 items, including miniature switches, special-purpose switches, electronic switch-circuit assemblies, lighted push-button switches, toggle switches, limit switches, proximity switches and mercury switches. Micro Switch, a Div. of Minneapolis-Honeywell Regulator Co., Freeport, Ill.

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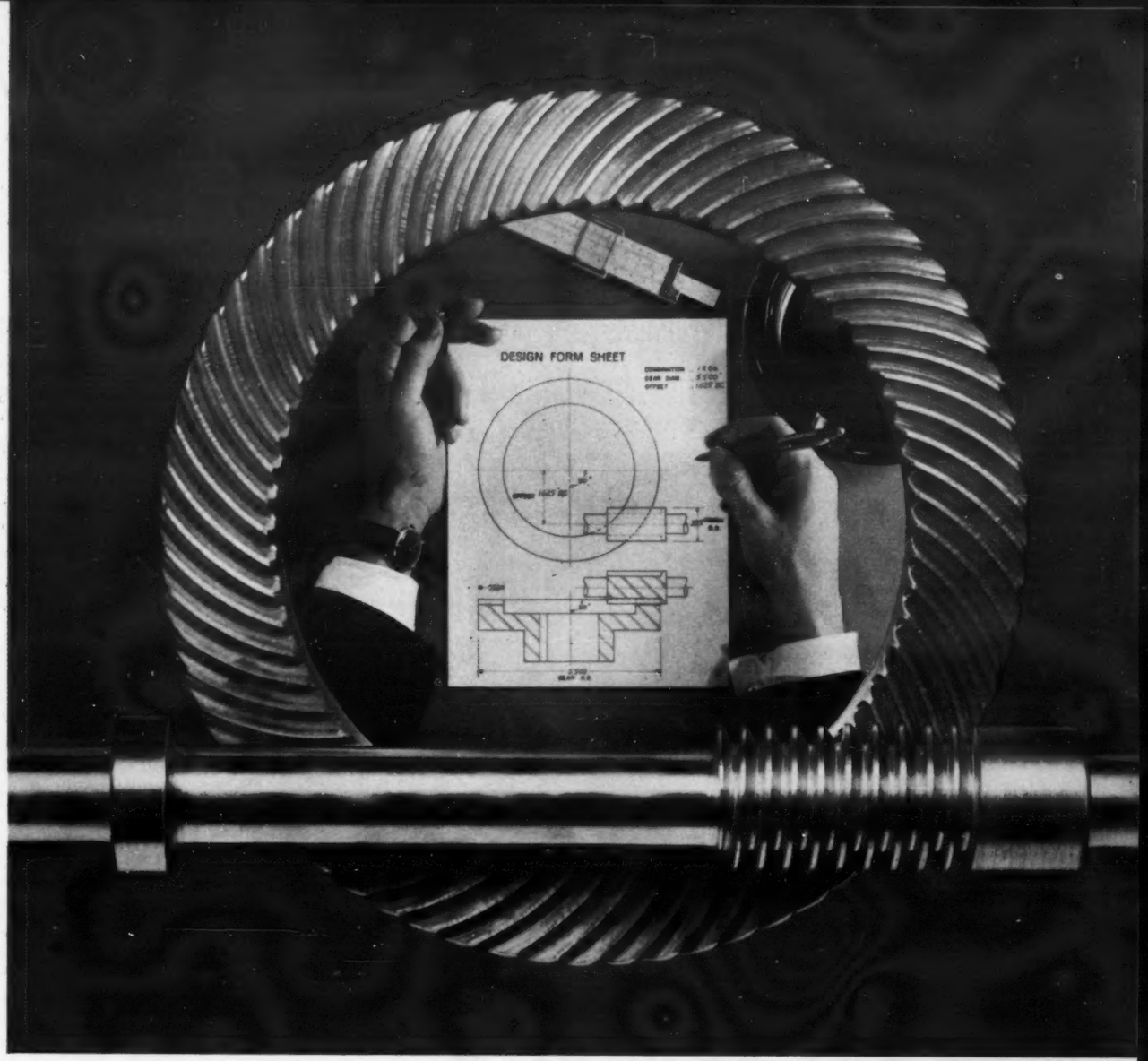

Why it will pay to design your high reduction gearing with Gleason HRH*

If you want to make your transmission more quiet or more compact or more flexible, take a good long look at the HRH set shown above.

This single set of gears gives a reduction of 66 to 1.

The action is quiet and smooth and continuous because the pinion teeth *wrap around* the gear teeth. With this design you can work such quiet operation into your designs even with a one- or two-tooth pinion member.

You can add the rigid support of a straddle mounting, since bearings can be put on both ends of the pinion.

HRH gear ratios are made with proven face mill cutting techniques, assuring complete control of tooth contact pattern to compensate for any assembly or operating condition.

HRH gear ratios are designed with the *full* assistance of all Gleason engineering services. We work with you on the practical design aspects and carry through to the development of prototypes. Then we furnish both machines and tooling for full production—*without royalties.*

Find out what HRH gearing can do for your transmissions. Send for our design form sheet and then send us the gear ratios and sizes you want. We'll send back detailed recommendations promptly.

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ALL STANDARD TYPES—Computing, Data Transmission, Phase Shifters and Sweep
ALL ENGINEERED & MANUFACTURED TO: MIL-R-14346
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A major break-through, made possible by VERNITRON specialization in precision synchro and resolver design and manufacture.

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SAVE TIME AND MONEY IN ALL THESE OPERATIONS!

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Mathematics Education And the Metric System

Dr. A. W. Jacobson,
Detroit Research Institute, Detroit, Mich.

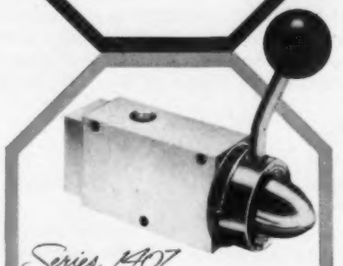
One of the basic requirements of our society is that mathematical talent be available in depth. This implies that our schools provide more extensive and up-to-date training for high school students. Therefore, it becomes incumbent upon educators and industrial leaders to promote those aids and methods which foster accelerated mathematics learning.

One of these aids would be to begin teaching decimal fractions at an early stage and postpone and minimize the teaching of common fractions. While we recognize that some of the common fractions are simple and easily comprehended by a child, we believe that the conversion to decimal fractions at an early stage is not difficult, nor will it retard progress.

In the workshops that the Detroit Research Institute has been conducting for the Detroit area teachers, we have agreed that the teaching of decimal fractions should begin early and continue throughout the grades and that the study of common fractions should be taken up later. We also have discussed the need for classroom use of such devices as scales in which the inch is divided into tenths, and in which the smallest division represents the fiftieth part of an inch or 0.02 inch. Likewise, the need exists for other measuring devices in which the units are subdivided into tenths.

The teaching profession is introducing the real number line to represent numbers. This is in accord with the fundamental mathematical principle that to every point on a line there corresponds one and only one real number and, conversely, that to every real number there corresponds one and only one point on the line. The modern trend in teaching of trigonometry is toward the emphasis of the trigonometric functions of real numbers, rather than that of angles measured in degrees, minutes and seconds. Thus, a real number which represents the length of the arc of a unit circle has for its end point the coordinates of the cosine and sine functions of the arc length. Thus, again we are dealing with the entire field of real numbers and not only with a small subset of real numbers expressed in degrees, minutes and seconds. Of course, the trigonometry in calculus and in advanced mathematics is based on the trigonometry of real numbers.

WATERMAN



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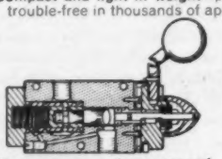
FLOW REGULATORS

Full range Adjustable *Pressure Compensated* Flow Control *to 5000 p.s.i.*

Waterman Series 1407 is a group of compact, low-cost, pressure-compensated flow regulators, adjustable over a series of unusually wide flow ranges, for convenient on-the-job speed control of hydraulic cylinders and motors.

Rated for pressures to 5000 p.s.i.
Controlled flow to 40 g.p.m.—ideal for hydraulic motors as well as cylinders. Factory-tested to 10% tolerance.
Wide range of adjustability—turndowns of as much as 80 : 1.
Choice of mountings and operating devices.
½" N.P.T.F. size meets most needs—standard sub-plate mountings available.
Compact and light in weight—proved to be trouble-free in thousands of applications.



Unit senses pressure drop across variable orifice and reacts to control flow within desired limits.

W-6120

Send today for new Catalog 1002.

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725 Custer Ave., Evanston, Ill.

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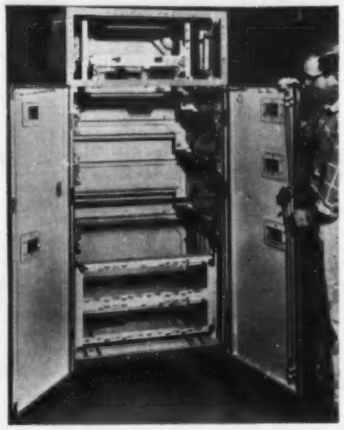
Example . . .



. . . of B & P capability to make lightweight metal assemblies for electronic equipment

Designing and manufacturing products and assemblies of light metals is a highly specialized field. Techniques unknown to production in other metals must be understood and new ones must be developed for unusual requirements.

Because it has concentrated on light metal manufacturing for many years, Brooks and Perkins today has experience and capability unmatched by any other organization.

The Nike-Hercules system magnesium cabinet shown above is just one example of B & P skill in maintaining close tolerances and optimum precision. Other products and assemblies designed and produced by B & P include . . .

• cooler plates • radar reflectors • communication equipment covers • radar reflector bases • equipment housings • tripods • radar plotting equipment • shelters • transit cases • gun fire control housings and turrets

When you need lightweight products or assemblies for electronic equipment, take advantage of B & P's experience and capability.

BROOKS & PERKINS, INC.
1936 W. Fort St., Detroit 16, Mich.
Offices in Washington and New York

61-T-2

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We do not wish to recommend that we immediately adopt the trigonometry of real numbers (the trigonometry of radian measure of the angle) but we do advocate adoption of a unit of rotary or angular measurement and its decimilization.

Another reason for the adoption of the decimal system is the fact that the electronic computers operate on a basis of decimal or binary number systems. This is also true of digital control machine tools.

As we have already noted, our schools need scales of measures based on the decimal system. The concomitant need is for teachers who know and understand these devices. Thus, a better and closer interchange of ideas between our teachers and people in industry and business is essential. In our workshops for school teachers at the Institute, we have discussed not only the basic concepts and methods of elementary mathematics and effective teaching methods, but we also have attempted to present that which is new in the science of elementary mathematics (such as the binary-number system). We also have brought in people from industry and business to discuss their needs and to contribute from their great source of knowledge and experience. In our workshop for teachers, we wish to supplement the program of the National Science Foundation Institute by providing the teachers with the great source of experience and knowledge available in industry and business.

You will note that we have not argued for or against the metric or English systems. We believe that the change will be a gradual one and that the best way for eventual adoption of the metric system is to decimalize our own units of weights and measures.

We wish to underline that:

1. Our society needs quantitative talent in depth.

2. Accelerated programs for acquiring mathematical competence begin with the lower grades.

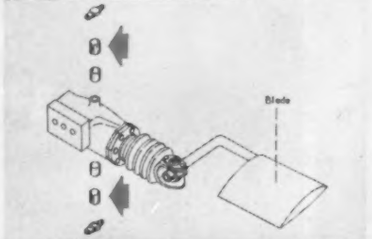
3. Retraining of our teachers and technical and scientific personnel in business and industry in the basic as well as advanced mathematical sciences should be undertaken immediately and on a large scale.

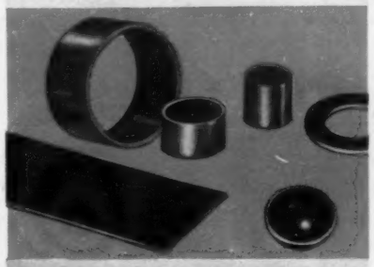
4. Our scientific progress and industrial advance hinges on the overall improvement in the basic concepts and tools of our technological culture.

5. Our national welfare and security directly depend on the rate and degree of progress in these areas.

Abstracted from a technical paper, "The Significance of the Change to Metric System to Mathematics Education"; SAE No. 287C; $.75; to SAE members, $.50. Society of Automotive Engineers, Inc., 485 Lexington Ave., New York 17, N. Y.

EXAMPLE #5





DU bushings (bottom) used in the rotor assembly (center) of Navy's all-weather helicopter (top), require no maintenance, last as long as the rotor itself under severest conditions.

DU* DRY BEARINGS Solve Another Problem

"On the basis of very successful results obtained from rigorous whirlstand testings which simulate in-flight rotor conditions, we incorporated DU bearings into production."

A. A. Coronato
Chief Component
Development Engineer
Sikorsky Aircraft Div.
United Aircraft Corp.

Used to eliminate the necessity of lubrication on the rotor damper assembly, DU bushings replace ten fittings that required daily greasing on the Navy's HSS-2 helicopter built by Sikorsky. The bushings offer satisfactory, trouble-free service for the entire life of the rotor hub despite a heavy load (1250 pounds at 203 cycles per minute, uni-directional), shock, vibration, intermittent motion and a corrosive environment.

DU metal is an ideal bearing material for many applications. It withstands much higher velocities, runs much cooler at lower speeds than other unlubricated bearings . . . has a compressive strength of 51,000 p.s.i. DU metal is applied without the need for temperature-limiting adhesives . . . will withstand from −450°F to +536°F.

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DESIGN DATA NEWS

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CONTROLS

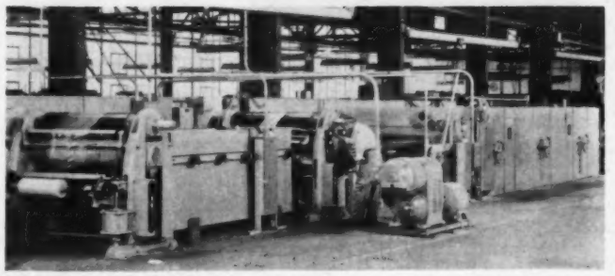
A-C Frequency Adjustable to Control Speed of Slave Motors

Edward W. Schrader, Western Editor

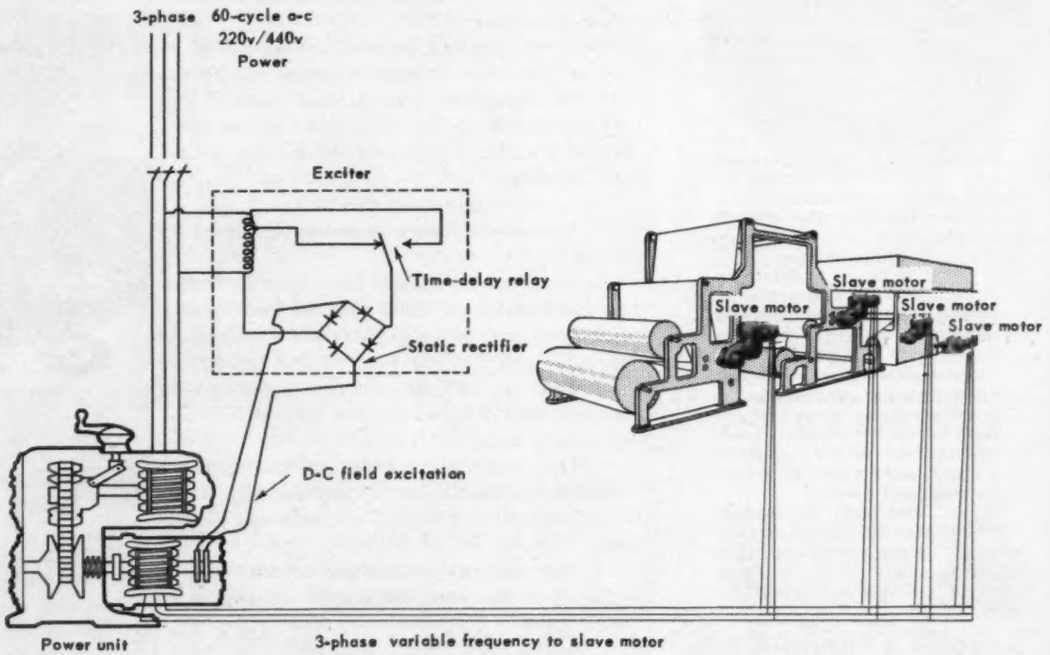
The output of a power unit is three-phase, variable-frequency to control the speed of slave motors. The system utilizes only alternating current for speed control of induction motors.

Three-phase, a-c, 60-cycle power is supplied to the induction motor driving the power unit. The variable-speed transmission in the power unit drives an alternator at any selected speed.

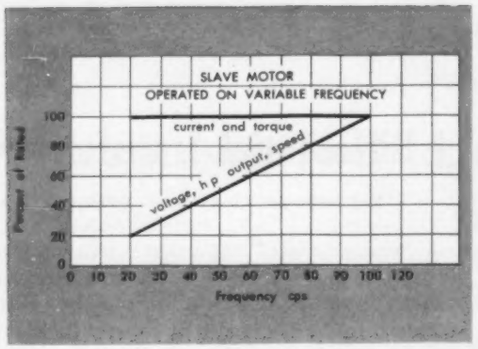
Output from the alternator is a three-phase, variable-frequency and variable-voltage a-c power. The speed of slave motors is in direct proportion to the frequency and hence varies in unison with the power unit.



POWER UNIT controls range drive for plastic sheet. Variable speed unit is mounted near mill and provides coordinated variable-speed control for individual slave motors.



A-C SLAVE MOTORS provide controlled speed system with changes in alternator speed. Alternator output is three-phase, variable-frequency from 20 to 100 cycles. Variable-speed transmission changes alternator output speed. Alternator field has separate field excitation. In constant torque application, speed control may be described as constant-current system. As alternator speed decreases, frequency and voltage inherently decrease together.



Separate excitation for the alternator supplies a d-c field voltage independent of alternator speed. Taps on two of the 60-cycle power lines provide a d-c voltage to the exciter. The exciter is a full-wave bridge rectifier.

In order to supply the high starting current drawn by the induction motor slave, a two-step exciter is used. The exciter supplies a higher-than-normal or "forcing" voltage to the alternator field during starting. This super-saturates the alternator field, which permits the alternator to supply a high current without excessive voltage drop. A time-delay relay in the exciter switches the field voltage to normal after the slave motor has started. Voltages will depend on the size and type of application.

The slave motors are standard a-c induction motors. In this system, however, both the frequency and the voltage are varied as a normal function of the alternator speed. Therefore, at low speeds, the alternator supplies low frequency and low voltage. At high speeds, the alternator supplies high frequency and high voltage. The voltage is changed with the frequency to maintain constant flux density and hence constant torque output of the induction motor slaves. It has little effect on the speed, which is geared to the output frequency of the power unit. The relative speed of the slave motors remains unchanged except for the individual slip characteristics of the particular induction motors.

For those special conveyor operations requiring a rigid speed relationship between slave motors, reluctance-type synchronous motors are used to eliminate any variations caused by slip.

Where process times vary with materials, the slave motor can power a variable-speed transmission. This arrangement offers a means of trimming the speed at that point in the web process. Speed changes in the system are still in unison with changes made at the power unit.

The Varidyne Controlled Speed System utilizing only a-c power for speed variation is a design development of U. S. Electrical Motors, Inc., Los Angeles, Calif.

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frenchtown engineered ceramics NEWS MEMO

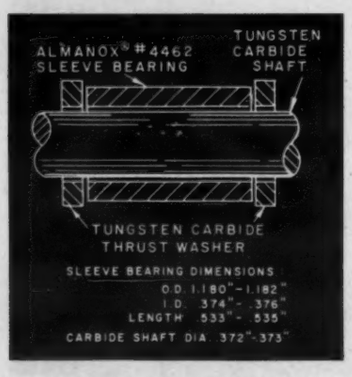
FRENCHTOWN PORCELAIN COMPANY • FRENCHTOWN, NEW JERSEY

Frenchtown solves own bearing problem

Discounting the old adage that a shoemaker's children go barefoot, Frenchtown solved its own bearing problem with the use of the well-known alumina ceramic material, Almanox® #4462.

In the grinding of unfired aluminum oxide spark plug insulator blanks, a daily maintenance operation consisted of replacing steel ball bearing assemblies. The extremely abrasive character of aluminum oxide dust, even in unfired ceramic compounds, reduced the service life of commercial ball bearings to less than twenty hours.

Substituting a sleeve bearing of Almanox® #4462, precision-ground to a clearance of .002", with a tungsten carbide shaft, resulted in a ceramic to carbide



relationship that has stood up for 24 months' service, 80 hours a week. And no lubricant is used; the bearing runs dry! Shaft speed is 800 rpm, driving a back-up wheel 2-1/2" dia. with a 3/4" face.

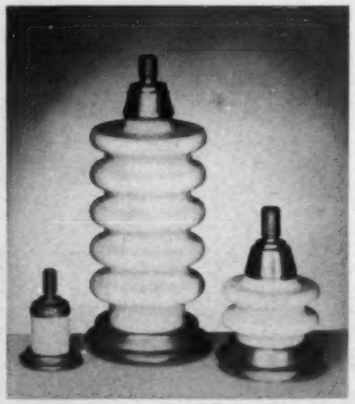
In addition, Frenchtown Almanox® #4462 is used in a variety of other company production equipment for wear resistant tracks, guides and mechanical parts.

Perhaps you have a plant application wherein a Frenchtown alumina ceramic material can do the job better, at far less cost. Write, telling us about your problem. No obligation, of course.

Circle 94 on Reader-Service Card

Frenchtown introduces new line of Feed-through and Terminal Bushings

Now available from Frenchtown are four series of fluted terminal bushings and three series of tubular terminal bushings for use where silver solder, brazing, or welding of terminal assembly to container is made necessary by higher operating temperatures than can be withstood by soft solder seals. These new Frenchtown lines are ideal for use by manufacturers of transformers, capacitors, filters, networks, and other large hermetically sealed units.

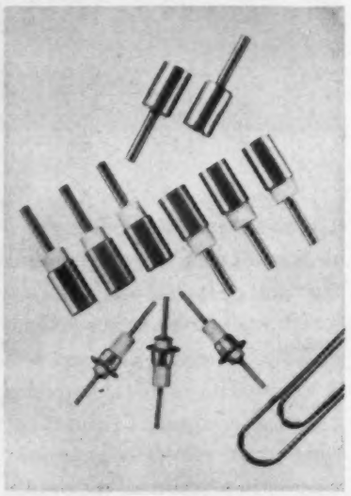


The insulator bodies are made of 94% alumina, Frenchtown #6536, glazed on external surfaces. All metallized areas are prepared by application of Molcote®, Frenchtown's patented high-temperature metallized coating. The metal hardware consists of nickel iron flanges and caps with fused silver finish. Terminal studs or lugs of cold rolled steel, are nickel plated. Assembly of metallized ceramic with hardware is accomplished by means of pure silver braze. Hermeticity of seals is determined by helium mass spectrometer leak detector. Write for detailed literature. No obligation, of course.

In addition to the new fluted and tubular terminal series, Frenchtown also introduces a new line of miniature feed-through bushings for use on unusually small hermetically sealed units, including temperature control devices and miniature electronic assemblies.

As with the fluted and tubular terminal series, these miniature hollow terminals are made of Frenchtown high alumina ceramic, with Molcote® metallized coating at all joint areas. Metal parts of nickel-iron or pure nickel are assembled with metallized ceramics by pure silver braze. Hermeticity is checked by a helium mass spectrometer leak detector.

The availability of these miniature units should enable the designer to make use of standards not otherwise available. Descriptive literature, complete with dimensional data, sketches, and general engineering information is available upon request. Check the key number shown below, or write us directly.



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Differential Transformers

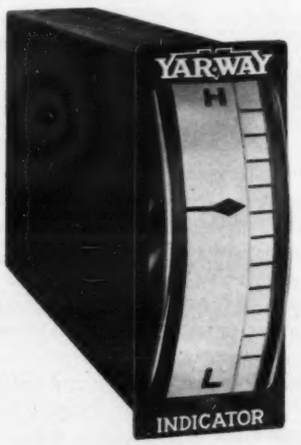
E. J. Stefanides, Central States Editor

Four series-connected differential transformers are used to provide error detection, correction feedback and zero calibration functions in a new system for remote indication of pressure differential. Two of these transformers are equipped with adjustable cores which can be fixed to provide electrical zeroing of the system. The other two are equipped with movable cores. One of these movable cores is mechanically connected to the spring-loaded diaphragm of the transmitter, the other to the pointer of the remote indicator.

Pressure differential across the diaphragm of the transmitter displaces its movable core, creating a voltage difference in the signal circuit. Signal current is amplified by a transistor amplifier which actuates the indicator through a solenoid motor. As the indicator moves, it also displaces the movable core of the receiver transformer an equal amount to balance the circuit again.

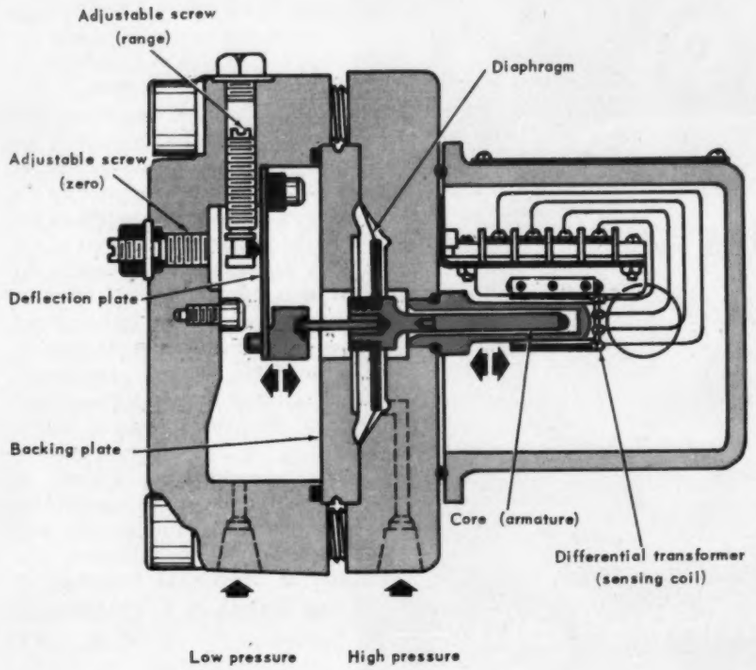
This combination provides an accuracy of three percent of full-scale deflection and can be operated with the transmitter and indicator separated by as much as 3000 ft. The only interconnection required is a four-wire shielded cable.

The components of this system were designed and are manufactured by the Yarnall-Waring Co., Philadelphia, Pa.

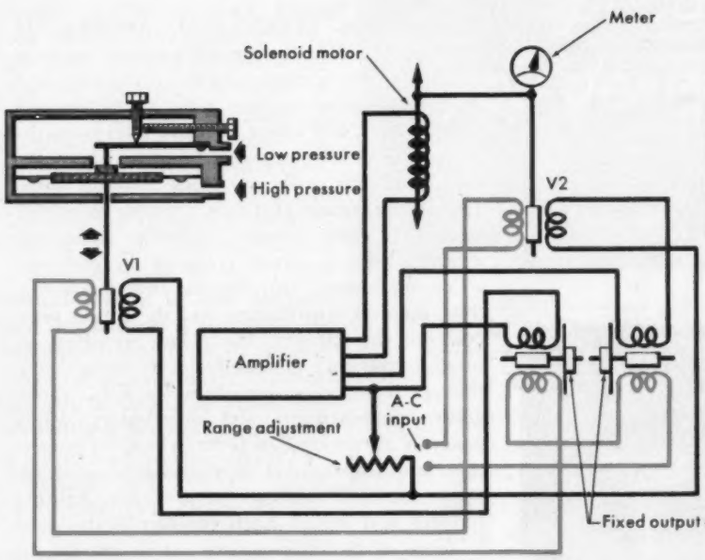


REMOTE INDICATOR is miniaturized with printed-circuit transistor amplifier, panel mounted with sliding mounting that allows access without interruption of indicator.

Provide Sensing, Feedback and Calibration



TRANSMITTER diaphragm movement is opposed by leaf-spring, deflection plate. Movement of diaphragm is transmitted to spring by low-friction, point-contact, floating pin. Movable core of differential transformer is connected directly to diaphragm follower, provides output which is linear to pressure differential. Operating in ranges of from 0 to 6 inches of water to 0 to 400 inches, this feature allows maximum full system pressure of 3000 psi without damage.



DIFFERENTIAL TRANSMITTING SYSTEM contains one sensing coil (differential transformer) in transmitter, three in indicator. Cores of two indicator coils are adjustable but fixed to provide electrical zeroing. Variable resistor bypasses part of signal current to provide indicator range adjustment. System components can be either 115v a-c or 6.3v a-c input.

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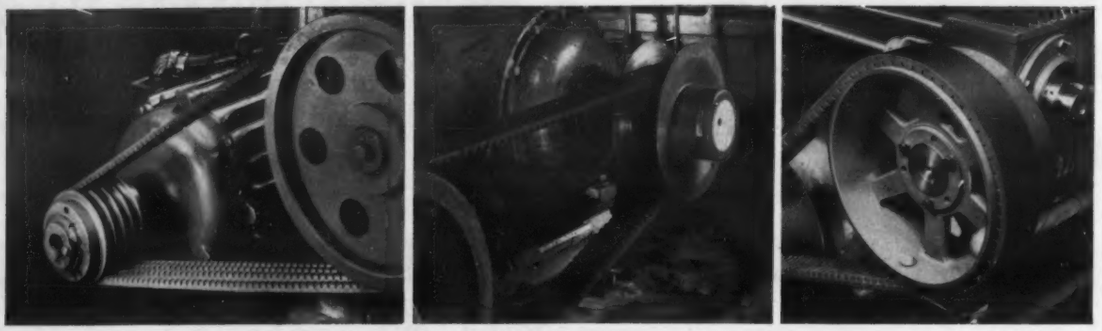

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NEW BOOKS

IDEAS, INERTIA AND ACHIEVEMENT. A survey of current opinion on how to shorten time lag between scientific discovery and engineering application. Sponsored by The American Society of Mechanical Engineers, this study was conducted by Fenton B. Turck and represents a cross-section of opinion on the problem of putting ideas into action. The book is separated into two major sections. The first has to do with the problem as aggravated by communications, or rather the lack of communications, between scientists and engineers. The second portion of the book pertains to the management aspects of the problem and how management can reduce the inertia between ideas and achievement. Obviously, this is a rather disconnected approach because of the many slightly differing opinions offered. The staff of ASME, however, has done a very good job of collating the various high-level opinions obtained and placing them in logical sequence. More than 100 individuals, companies and institutes are represented in the study. In view of the current interest in trying to bring together the scientists and engineers, the opinions expressed here are of timely interest. The American Society of Mechanical Engineers, 29 West 39th St., New York 18, N. Y.; 200 pages; $5.

MARKETING ELECTRICAL APPARATUS AND SUPPLIES. To comprehensively appraise the entire field of marketing industrial electrical products—how it operates, what its factors and problems are, and where and how improvements in its various elements may be attained—is the purpose of this newly published 306-page book. The author, Edwin H. Lewis, presents an overall view of the entire industry, including discussions of such topics as current competition, problems of manufacturers, distributors and representatives, markets, distribution and the future prospects for the industry. Many data are given, of prime importance to manufacturers' agents, contractors, service organizations in the field, wholesalers, manufacturers and distributors. Many products are covered, including electrical generation and transmission equipment, control devices, electrical construction materials, lighting fixtures and lamps. Each product is discussed in terms of the characteristics of its market, its distribution and the problems it presents to distributors. McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36, N. Y.; $9.

TV TROUBLE ANALYSIS. A new approach to TV trouble-shooting is outlined in the latest Gernsback library book No. 101. After giving the reader a brief, but up-to-the-minute TV theory refresher course, Harry Mileaf explains the "theory of trouble". He shows how and why components and circuits fail and how these failures affect the audio and video in a TV receiver. The effects that circuit troubles have on TV receivers are illustrated, along with the effects circuit troubles have on TV waveforms. By familiarization with the theory and operation of the receiver in trouble, the technician will prove his practical performance by cutting down on servicing time and will increase his ability to pinpoint troubles of unfamiliar sets. Gernsback Library, Inc., 154 W. 14th St., New York 11, N. Y.; 224 pages; $4.95.

PRACTICAL STATISTICS IN EXPERIMENTAL DESIGN. This is an introductory text of practical, statistical methods and applications for engineers. Previous experience in statistical methods is not required for understanding the principles explained in this book. Of special interest are specific examples given for the use of statistical methods in experimental work. A chapter on graphical presentation of data is also of interest. This is one of the simplest approaches to the problem of statistical analysis in data we have seen to date. As a handbook for reference by engineers, or as a text for a short course in statistical analysis in industrial plants, this should be a practical approach to a common problem. By A. W. Wortham and T. E. Smith, Semiconductor-Components Div., Texas Instruments, Inc.; Charles E. Merrill Books, Inc., 1300 Alum Creek Dr., Columbus 16, Ohio; 136 pages; $6.60.

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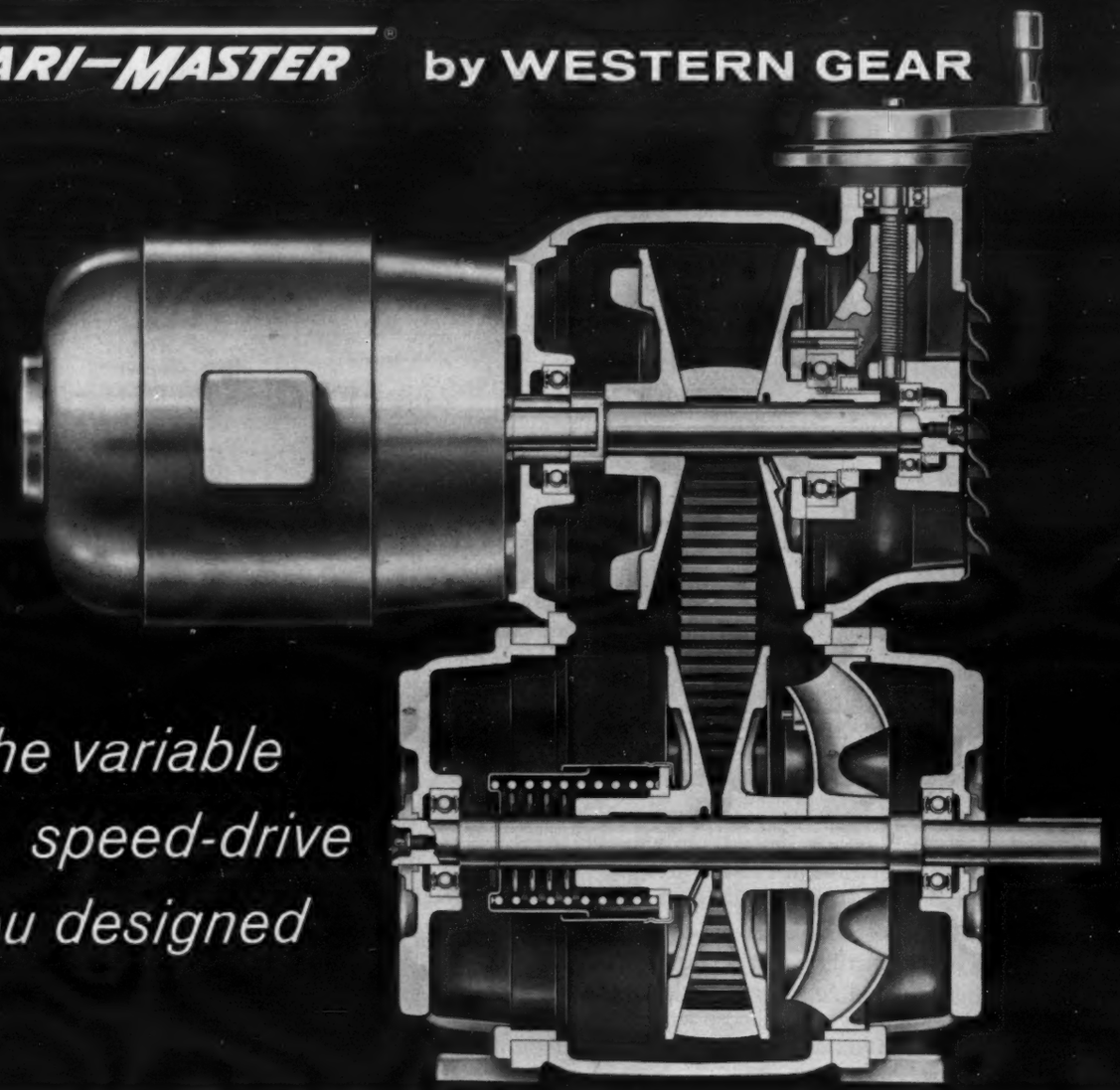

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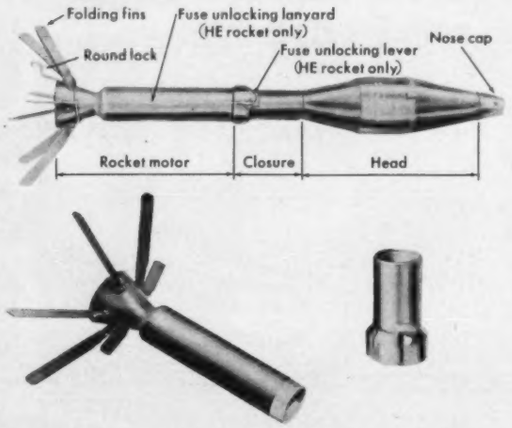
SCANNING PRESS RELEASES

• **TANK KILLER GRENADE** utilizes a super-strength aluminum alloy which meets strength requirements beyond any commercially available material. The super alloy, developed by Bridgeport Brass Co., has 85,000 psi minimum tensile strength and 80,000 psi minimum yield strength.



The Army's latest light anti-tank weapon, M 72, in current readiness for production, is light in weight, extremely accurate and can be carried and fired by one man from a standing, kneeling or prone position. The 4½-lb weapon is carried over the shoulder in a dual-purpose, throw-away case that serves as a launcher. Collapsed, the carrying case is 25 inches long and 3 inches in dia. The grenade is propelled by a new solid-fuel motor which develops maximum thrust before rocket leaves launcher tube.

The two aluminum cold forgings make up the powerful motor for the low-pressure propulsion system. When the rocket emerges, several narrow tail fins spring into position and stabilize the rocket in flight.

The grenade assembly, weighing only 2.2 lb, is 20 inches long and 2¾ inches in dia.

Rocket, grenade and launcher were developed by Hesse-Eastern, Everett, Mass.

TABER TELEFLIGHT® 183

goes with the "BIRD"

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The PRESSURE TRANSDUCER that dissipates HEAT to its CASE to defeat zero gravity heat build-up

There is a whole family of Teledyne and Teleflight Pressure Transducers available for airborne or ground support applications. One of our stars in the missile and rocket field is our Model 183 Teleflight at the left. This transducer precisely measures liquid or gas pressures to 0.25% over a wide temperature range. Bonded Strain Gage construction assures low sensitivity to shock and vibration. When the Teleflight is subjected to zero gravity conditions (as in space flight where convection cooling is non-existent) the Ni-Span proving ring acts as a heat sink and conducts heat AWAY from the resistance gages to the instrument case. Handles corrosive media including fuming NITRIC ACID. With slight factory modifications, can also handle Fluorine. 200% overload protection built in at no extra cost. Infinite resolution, Linearity 0.25%, Hysteresis 0.25%, Temperature −100°F. to +275°F., Repeatability within 0.1%. Pressure ranges of Model 183, shown, 0-100, 0-200 PSIG or PSIA. Other models available up to 0-10,000 PSIG or PSIA. Taber also produces a complete line of miniature transistor amplifiers or will build complete Electronic Systems to your specifications.

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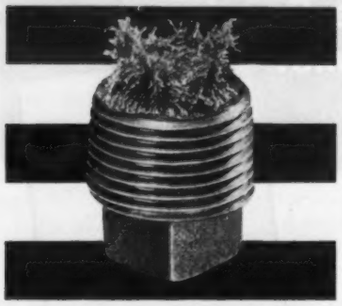

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Lisle Magnetic Plugs can be used in place of any ordinary drain or fill plug.

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Clarinda, Iowa

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• **ESCAPE CAPSULE** may eject a man from B-58 Hustler bomber flying at supersonic speeds of more than 850 mph. This would be the fastest controlled ejection ever made from an airplane. However, before man is ejected, fully articulated dummies will be used to prove out the system.

The B-58, capable of speeds of more than 1300 mph, is the fastest bomber in the world. It is manned by a crew of three. For the test program, all ejections will be made from the second crew station.

The capsule has been fired successfully from the B-58 on the ground at Convair-Fort Worth. The capsule, weighted to simulate a crewman, was ejected by rocket catapult; then the capsule's own rocket engine powered it up about 250 ft. All phases of the ejection (catapult, rocket engine, stabilization and recovery) worked perfectly.

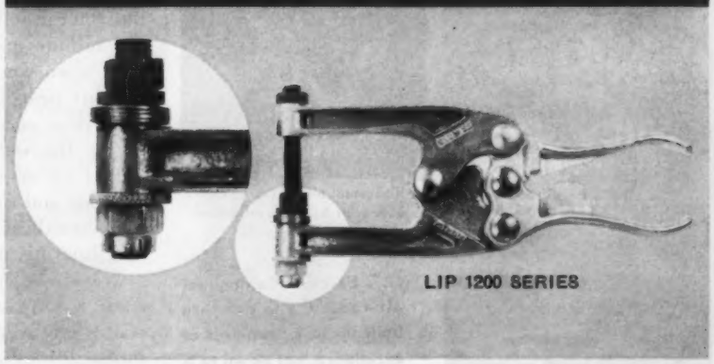
Subsonic ejections will be made at various altitudes before a supersonic ejection is tried. Chase planes and helicopters will follow capsule's descent.

In operational use, if it becomes necessary for crew to escape from the airplane, each crewman will trigger his own capsule's mechanism. The capsule closes, completely enclosing the airman, who then activates ejection system. After capsule clears airplane and descends to proper altitude, a parachute opens automatically to lower the capsule to the surface.

On land, sea or ice, capsule will provide airman with a habitable environment and protection from the elements. Equipment inside will enable him to survive until a rescue team can answer a call from the capsule's self-contained radio.

The tests are being conducted by the Convair Div. of General Dynamics Corp.

NEW *KNU-VISE* LOAD INDICATING PLIERS GUARANTEE CLAMPING FORCE



These pliers are for applications where it is essential, and often critically so, that a certain clamping force be applied time after time—*regardless of the thickness of the work.*

In use, the adjusting spindle is set for the desired clamping force by trial clamping. When the proper force is obtained, the self-locking nut on the anvil is then adjusted so that the LOAD INDICATING WASHER moves "just smoothly" with the plier clamped on the work. Thus, once a certain clamping force has been established it can be readily duplicated on any other work thickness simply by adjusting the spindle so that the LOAD INDICATING WASHER again moves "just smoothly" after clamping.

Write for complete information.

Manufacturers of over 150 models of manually and air-operated clamps and pliers

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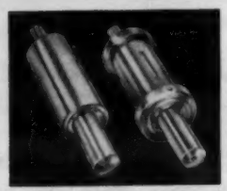

(Left) plain type. (Right) with longitudinal positioning nuts. Both are shown with BLANK SPINDLE END for machining by user.

Gilman
CARTRIDGE-TYPE
SPINDLE ASSEMBLIES

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AVAILABLE in plain cylindrical type or with longitudinal positioning nuts. Five types of spindle noses are offered. Range of cartridge diameters from 1.250" to 2.750".

Design Advantages

- Steel spindles are precision machined and ground, with close tolerances maintained throughout.
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- Spindle assemblies can be mounted in a bored hole or in Gilman precision mounting brackets.

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RELEASES

• **YOU WON'T KNOW THE RIGHT TIME,** but you can tell how many times your heart beats per minute and just when it is thumping the most when you wear a portable gadget known as a Heart Beat Totalizer. By ingenious but simple conversion of an inexpensive wrist watch and by wiring the watch to a tiny amplifier weighing only 1 oz, research scientists have produced an accurate and convenient way of measuring a person's heartbeat night and day, while the wearer continues his normal way of life.

Previously, the changing rate of heartbeat could readily be measured only while the subject was in bed or sat next to bulky instruments. This unit will totalize a person's heartbeat while he is working at his office desk or running for the bus, or while she is doing her housework or is screaming at the children.

Three totalizers have been pronounced totally

satisfactory, except for one "bug"—an electric shaver will interfere with heartbeat count, and electrical interference caused by ignition systems in some older model cars is also stronger than heart voltage.

How does the totalizer work? Two electrodes, pieces of lead foil about the size of a postage stamp, are taped to the chest. From each electrode comes a small wire and these wires connect to a battery-operated amplifier which is so compact that it is smaller than a pack of gum and can be clipped to a man's undershirt. The beating heart produces very weak voltages across a person's chest. This voltage is increased in strength by the amplifier. The amplified voltage is then transmitted by a thin double wire to the wrist watch.

The device was developed by missiles and space men of Lockheed Aircraft Corp.

Does R & D on Your Product Involve Bearing Problems?

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NEW 2-pole device mounts in same space as single-pole switch . . .

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- Variety of arms available

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wherever electricity is distributed and controlled

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• **SPLIT-SECOND PULSES** of intense neutron radiation will be used in a new attack on mysteries of the fission process which still remain unsolved 22 years after the energy of the atom was unlocked. Prof. Fritz Strassmann, co-discoverer of nuclear fission, believes there are short-lived primary fission products, created in the splitting of the atomic nucleus, which have not yet been detected.

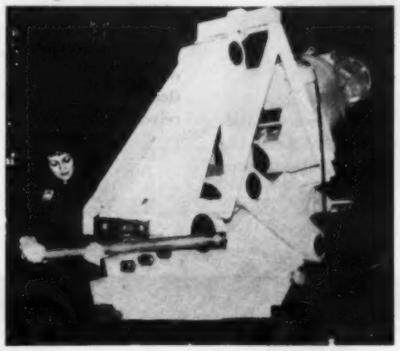
At a press conference at Johannes Gutenberg University of Mainz, Germany, where he is director of the Institute for Inorganic and Nuclear Chemistry, Prof. Strassmann said he hopes to identify and measure these elusive fragments. Beams of high-speed neutrons will be produced in a TRIGA research reactor, especially adapted for self-regulating pulsed operation by General Dynamics Corp.

The reactor's uranium fuel is intimately mixed with the hydrogen moderator in solid form in a structural lattice of zirconium. This provides TRIGA with what is known as a "prompt negative temperature coefficient" which means, in effect, that it has a builtin "thermostat" which governs its safety.

As the nuclear chain reaction is speeded in the reactor's core, increasing the output of heat energy and raising the power to thousands of times its normal 30-kw level, intense neutron radiation occurs. Instantaneously, the hydrogen moderator absorbs the excess heat, slows down the neutrons and automatically brings the chain reaction back to a normal rate. All this occurs in a few millisec.

• **EIGHT-TON "NUTCRACKER"** will cut tough, radioactive stainless-steel pipe into small, manageable pieces for atomic burial and will save costly connector parts. The pipes, called "jumpers" by chemical processing people, are the metal arteries that link the complicated machinery used for extracting plutonium and uranium from fission leftovers. Savings in the burial of radioactive, wornout pipes, will come to about $11,000 annually.

When in use in the Hanford Chemical Processing Dept., operated by General Electric for the Atomic Energy Commission, the "nutcracker" will perform an untouched-by-human-hands operation.



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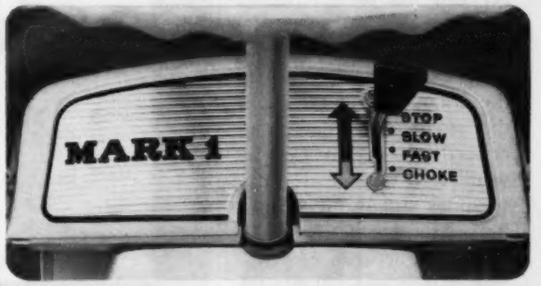
Fasson Self-Adhesive Grill and Dash Trim Save Porter-Cable 25%



"Arthur Pulos, our industrial design consultant, suggested these weatherproof Fasson Mylar-Vinyl panels to inexpensively dress up the tractor's styling and achieve brand name remembrance," reports Porter-Cable's chief engineer, Richard Lamkin.

"The application of the self-adhesive panels is a simple, assembly line procedure, and is a definite time-saver compared to painting or adding actual parts for the grill and dash panels. Using Fasson saves us 25%."

Put more sales appeal in your products . . . economically . . . with decorative trim and nameplates of durable, gleaming Fasson self-adhesive Mylar*-Vinyl.

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• **INITIAL PRACTICAL APPLICATION** of the laser, or optical maser, is in a new radar called "Colidar" for Coherent Light Detection and Ranging. Colidar is claimed to provide the first practical long-range radar for use in outer space.

Colidar's transmitter is a laser that generates a nearly parallel, monochromatic (single-colored) light beam and its receiver is an optical system coupled to a photoelectric tube. The laser's red beam strikes a target and is reflected. Some of the reflected energy is directed back to the source where it is collected and processed to obtain information such as range and angle of a target.

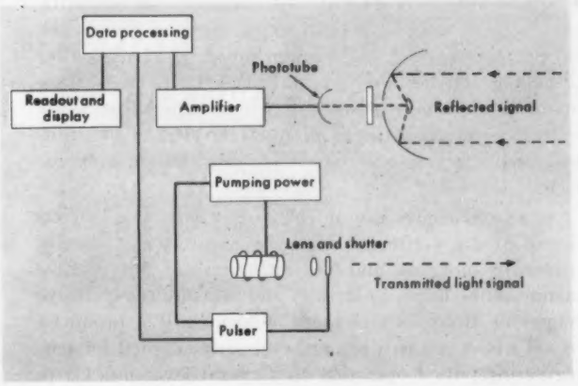
Colidar's receiver is a telescope which collects and focuses the light through a filter and into a phototube to provide signal amplification. Part of the laser light triggers a timing system which notes the exact moment the light pulse is emitted. When the light pulse is bounced off the target and has been reflected back to the collector, the time again is registered and this measure of time provides the distance of the target. In the attenuating atmosphere of earth, the present Colidar would have a range of nearly six miles, and at this distance its narrow beam would discriminate between two diffuse objects only 10 ft wide placed side by side, even though the targets would reflect only 10 percent of the light pulse.

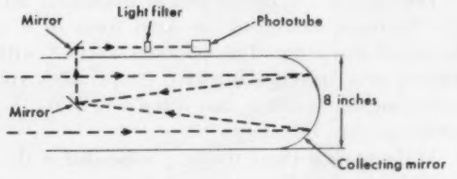
If Colidar's transmitter and receiver were separated and placed aboard two spaceships 100,000 miles apart outside the earth's atmosphere and carefully aimed at each other, the receiver would get the same signal strength as from the six-mile target in the radar application on the ground.

The Colidar radar was developed by Hughes Aircraft Co.

LASER transmits beam of nearly parallel, monochromatic light. Receiving telescope collects reflected signal from target.

PULSER initiates signal which feeds pumping power to laser (center, in spirals). Light beam then passes through lens and shutter to form transmitted signal. Reflected signal is collected by mirror, focused on smaller mirror and passed through filter into phototube. Finally, signal is amplified and processed. Line drawing (below) shows position of mirrors and path of reflected light in receiver.





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Without bias, Robertshaw will recommend *the* type of bellows best suited for the conditions to which your application will be subjected.

From inquiry to delivery, Robertshaw gives you personal attention, whether your need is for a prototype or several thousand bellows. In addition, Robertshaw offers FORMFLEX and FORMWELD Bellows as "packaged" units—complete assemblies custom-designed for ease of installation and lasting performance.

Write for Bulletin BT 436—see why Robertshaw is today's most advanced line of metallic bellows. Or call now for a Robertshaw representative to help you with your problem.

BRIDGEPORT THERMOSTAT DIVISION
Robertshaw-Fulton Controls Company • Milford, Connecticut

• **THERMAL DRILL** will probe more than two miles deep into polar ice-caps, further than man has ever penetrated before. The U. S. Army Corps of Engineers' Cold Region Research and Engineering Laboratory is using the drill to obtain ice cores for military and scientific study as a follow-up to the International Geophysical Year.

The thermal drill is 23 ft long and looks like a hollow telephone pole. The electrical equipment is located at one end and a circular heating element is at the other.

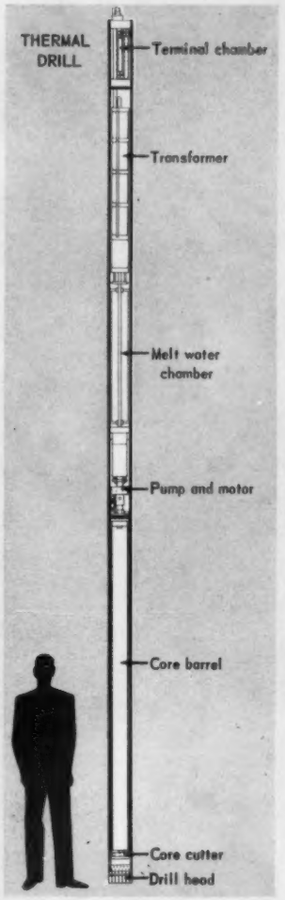
Heated to a maximum of 400F, the element melts its way around a core of ice at the rate of six inches a minute. The core is held in the drill and removed when the drill is lifted. By successively removing 10-ft ice cores, the drill can reach its maximum penetration.

The 6-inch-dia hole made by the drill is kept filled with Arctic diesel oil. This keeps the pressure of the ice from collapsing or closing the hole. Thus, the drill operates entirely immersed in an oil bath.

By extending their ice research 12,000 ft down, Army engineers hope to obtain data which will aid in the construction of future military and radar installations in polar regions. In addition, this research may provide clues to the history of previous climates.

The device was built by Pollak and Skan, Inc., Chicago, Ill.

DRILL is lifted to surface each time core has filled its core chamber. Spring-loaded teeth bite off core when drill is lifted.



SIX SECTIONS make up drill. Power cable is attached to terminal chamber. Forty-one-inch long, 5-section transformer steps down 2,300v to 230v. Limit switch in core barrel signals crew when barrel is full. Core cutter consists of spring-loaded teeth which separate core from ice and hold core in place when drill is lifted. Drill head consists of 20 cartridge-type heating elements. Suction holes in head permit melted water to be drawn up into water tank.

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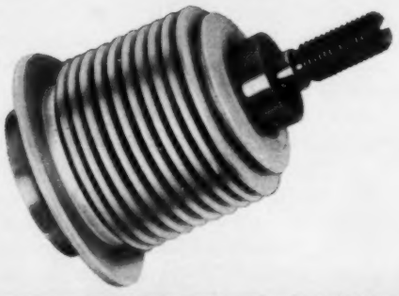

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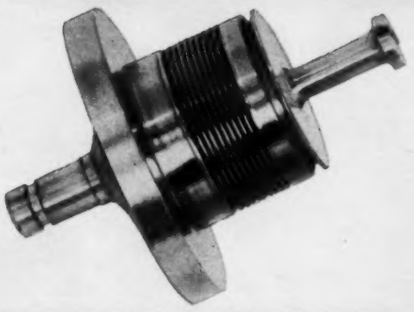
For normal temperature, pressure sensing applications!

Robertshaw FORMFLEX Bellows are available in sizes from ⅛" O.D. to several inches O.D.

Metals available include brass, phosphor bronze, beryllium copper, Monel, stainless steel, Inconel, Inconel-X, etc. Single or double-ply bellows are regularly produced, with additional plies available on special order.

Important cost savings are possible when Robertshaw produces the complete "package"—eliminating scattered orders, separate deliveries and inspections, and different interpretations of quality. Write for Bulletin BT 436

*Registration pending



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(WELDED)

For applications requiring premium performance!

Welded of any suitable alloy, Robertshaw FORMWELD Bellows give you the exact properties and characteristics you require. Resistance to temperatures above 1000°F., pressures to 3000 psi plus. Far greater flexibility per unit of length, lower hysteresis, greater load capacity without deformation and lower spring rates are available when you specify FORMWELD Bellows. Bellows sizes from ½" O.D. to several inches. Sold only in complete "package" units. Write for Bulletin BT 436

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A DIVISION OF THE EAGLE PICHER COMPANY

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RELEASES

• **TWO-WHEELED DREAM CAR,** the "Gyron", is a delta-shaped vehicle envisioning two running wheels instead of the usual four.

The car is 209 inches long, 44.85 inches high, 86 inches wide and has a road clearance of 6½ inches.

Although the car is not operable in its present form, Ford stylists have been assured that a gyroscope no larger than two ft in dia would be sufficient to stabilize the vehicle on its two wheels set in tandem. Two small outrigger wheels toward the rear and on each side are retractable. They could be lowered automatically to balance the vehicle when the gyro was inactive or until it had gained enough momentum to provide stability.

The "horseless carriage" accommodates two people in contoured seats, which support not only the head and back but the upper part of the legs as well. A projectile-shaped console separates seats and houses controls for the canopy, air conditioning, the gyro and adjustable foot bars that extend at right angles from the console.

Elimination of the steering wheel is made possible through the use of a steering dial with separate rings for automatic speed and steering control. This dial, combined with individual accelerator and brake pads on each foot bar, permits steering from either seat.

The growing influence of "machines that think like humans" is apparent in the console in the 10-button panel that supposedly would control a builtin computer. Such a system might enable a motorist of the future to "program" a journey on a nonstop expressway.

More than half a century ago, a Detroit artist-engineer named James Scripps Booth proudly introduced his "Bi-Autogo", which appeared briefly on the scene in 1908. It also had two wheels

and originally was meant to be balanced by means of a gyro installed under the driver's seat.

Unfortunately, Booth found it almost impossible to return the front wheel to a straight-head position after the car had turned. Power steering easily overcomes this difficulty in the modern automobile. Also, a modern hydraulic system would have made totally unnecessary the considerable physical strength that was required to operate the Bi-Autogo's "landing wheels".

Meetings

Dallas, Tex. **Apr. 30-May 4**	NATIONAL AEROSPACE INSTRUMENTATION SYMPOSIUM, Instrument Society of America, Adolphus Hotel.
San Francisco, Calif. **May 2-4**	ELECTRONIC COMPONENTS CONFERENCE, Institute of Radio Engineers, American Institute of Electrical Engineers and Electronic Industries Association, Jack Tar Hotel.
Urbana, Ill. **May 7-8**	MIDWEST SYMPOSIUM ON CIRCUIT THEORY, Institute of Radio Engineers, University of Illinois.
Miami Beach, Fla. **May 8-9**	LUBRICATION SYMPOSIUM, American Society of Mechanical Engineers, Deauville Hotel.
Dayton, Ohio **May 8-10**	NATIONAL AEROSPACE ELECTRONICS CONFERENCE, Institute of Radio Engineers, Miami and Dayton Biltmore Hotels.
Los Angeles, Calif. **May 9-11**	WESTERN JOINT COMPUTER CONFERENCE, Ambassador Hotel.
Philadelphia, Pa. **May 10-12**	MEETING, Society for Experimental Stress Analysis, Benjamin Franklin Hotel.
Detroit, Mich. **May 22-25**	DESIGN ENGINEERING SHOW, Cobo Hall.

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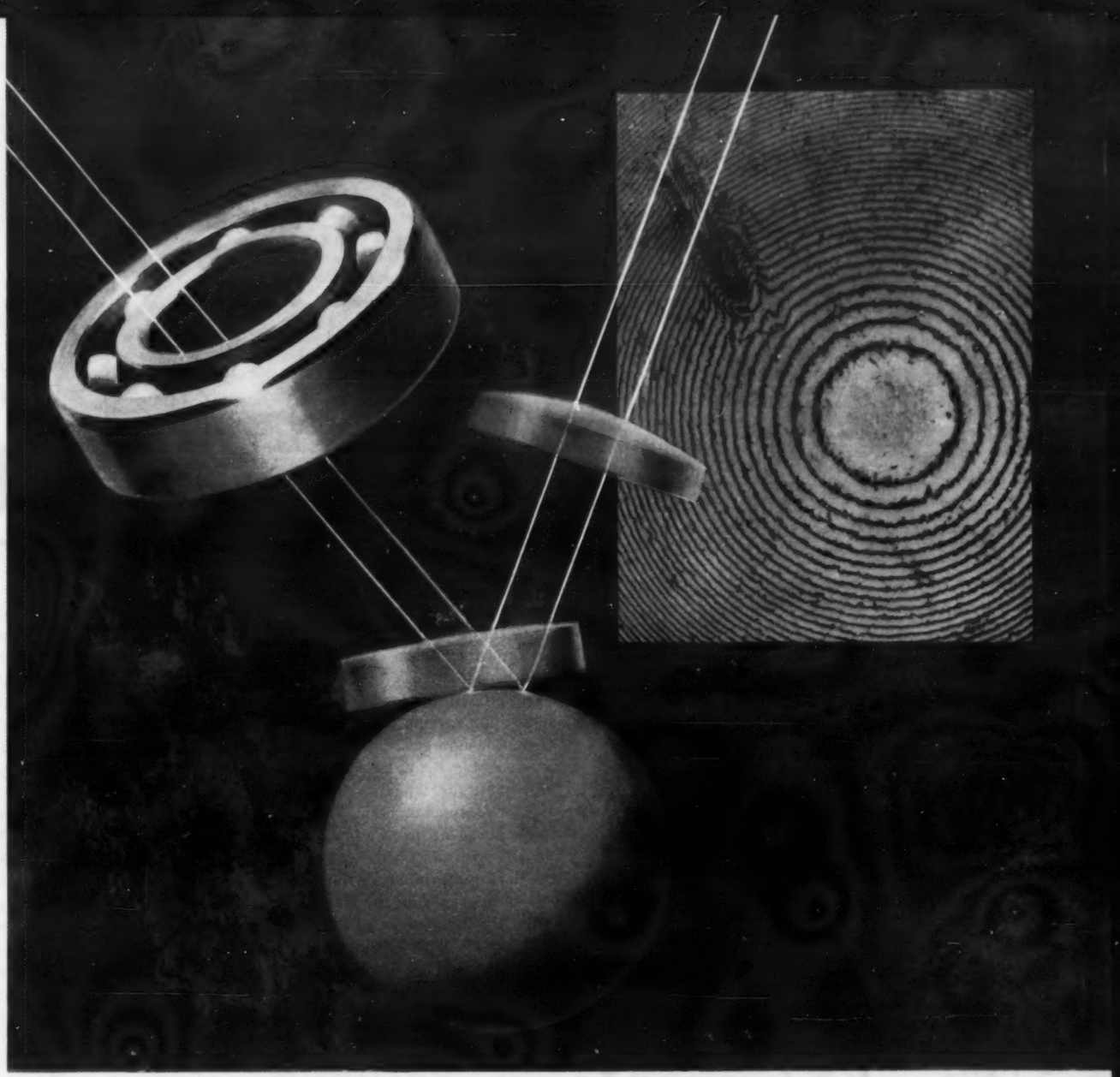

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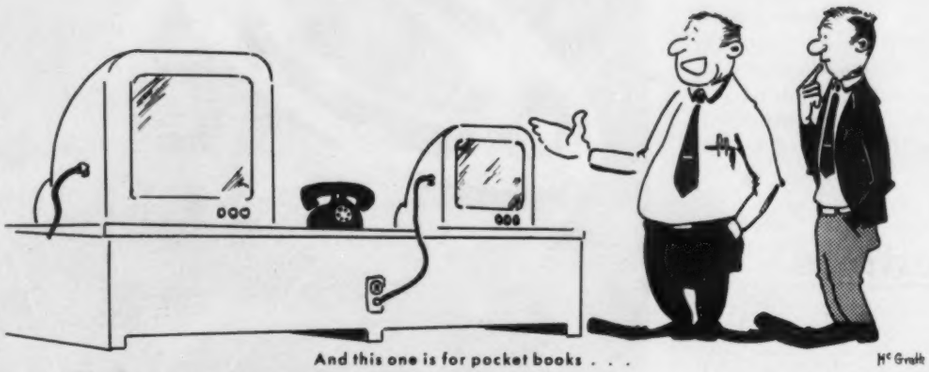

And this one is for pocket books . . . Mc Grath

By the year 2000, the United States will have to have an automated national library, according to the prediction of Prof. J. G. Kemeny of Dartmouth College.

Each page of each "book" in this library, he suggested, will be stored on approximately one square mm of tape. Patrons will neither go to the library nor see the master tapes. Copies will be made for them to read, conveniently enlarged, on the screens of viewing devices in their own offices or homes.

Obtaining a copy of a book will be like making a long-distance call—a person will merely dial the appropriate code number and the book will be inserted into the viewing machine electronically. The reader will be able to keep the book on his tape as long as he wishes, then erase the tape and have another book "sent" to him.

Such a library will be needed, Prof. Kemeny said, because if the present rate of growth continues, even our richest universities will not be able to afford building, cataloging and maintenance of present-type libraries. Even though a national library might cost a billion dollars, he contended, it could prove to be more economical than continuance of the present system.

Prof. Kemeny envisions a library of 10,000,000 volumes in 2000 A.D. that will grow to possibly 300,000,000 volumes by 2100 A.D.

To meet the need of those readers who object to being deprived of the pleasure of browsing, Prof. Kemeny notes that a few hundred thousand old-fashioned, printed books could be kept on local shelves.

'Gas' Antennas

Spaceships of the future may communicate with each other by using the exhaust gases fired from rockets as radio antennas.

Ionized exhaust gases are good electrical conductors and can be used to send out and receive messages from other spaceships, notes B. Mindes of International Telephone & Telegraph Corp. Federal Laboratories.

A whole new frequency range for communication would open up without increasing the weight of the vehicles. The long exhaust trail in the sky would act as an antenna for communicating in lower frequency radio bands, which until now have not been used because they require large antennas.

I think it was the coffee stains that threw us off.

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req'd = 1000 watts, 50 cycles
for 2 pole - rpm. = 50 x 2 x 60 / 2 = 3000
for 4 pole = 50 x 2 x 60 / 4
assume generator efficiency 70%
engine watts output = 1000 / 70 x 100 = 1430
engine horsepower output = 1430 / 746
engine rating, allowance for temp
altitude, cylinder head deposits
allow 25%
engine rating = 192 / 75 = 2.57
80200 rating at 3000 rpm. 2.74
check - max rec op hp at 3000 2.24
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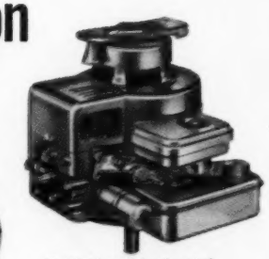

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